IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

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| W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA, | ) |
| Plaintiff, | ) |
| vs. | ) 4:05-CV-00329-TCK-SAJ |
| TYSON FOODS, INC., et al, | ) |
| Defendants. | ) |

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THE VIDEOTAPED DEPOSITION OF TOMMY DANIEL, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 26th day of November, 2007, in the City of Fayetteville, County of Washington, State of Arkansas, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

**Exhibit D**

A P P E A R A N C E S

FOR THE PLAINTIFFS: Mr. Richard Garren
Attorney at Law
502 West 6th Street
Tulsa, OK 74119
-and-
Mr. Louis Bullock
Attorney at Law
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FOR TYSON FOODS: Mr. Robert George
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FOR CARGILL: Mr. John Tucker
Ms. Leslie Southerland
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Tulsa, OK 74103

FOR SIMMONS FOODS: Ms. Vicki Bronson
Attorney at Law
211 East Dickson Street
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FOR PETERSON FARMS: Mr. Scott McDaniel
Attorney at Law
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Tulsa, OK 74103

FOR GEORGE'S: Mr. Paul Thompson
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I N D E X





(Whereupon, the deposition began at 9:05 a.m.)

VIDEOGRAPHER: We are now on the Record for the deposition of Dr. Tommy Daniel. Today is November 26th, 2007. The time is 9:06 a.m. Would counsel please identify themselves for the Record? 09:05AM

MR. GARREN: Richard Garren for the State of Oklahoma.

MR. BULLOCK: Louis Bullock for the State of Oklahoma. 09:06AM

MR. THOMPSON: Paul Thompson, Junior, on behalf of the George's defendants.

MR. TUCKER: John Tucker and Leslie Southerland for Cargill.

MR. McDANIEL: Scott McDaniel for Peterson Farms. 09:06AM

MR. GEORGE: Robert George for the Tyson defendants.

MS. BRONSON: Vicki Bronson for Simmons Foods.

VIDEOGRAPHER: Thank you. The witness may be sworn.

TOMMY DANIEL, PhD,
having first been duly sworn to testify the truth, the whole truth and nothing but the truth, testified



as follows:

DIRECT EXAMINATION

BY MR. GARREN:

**Q Dr. Daniel, would you please state your full name to the court, please.** **09:06AM**

A Tommy Curtis Daniel.

**Q And you're here by subpoena today; is that correct?**

A Correct.

**Q We've not spoken before today; in fact, have not met before today; is that true?** **09:06AM**

A Correct.

**Q Have you ever given a deposition in the past, sir?**

A Probably 20 years ago, yes. 09:06AM

**Q Let me just go over some ground rules to make it a little bit easier for both of us.**

A Thanks.

**Q I'll be asking questions and would like for you to respond to those questions verbally rather than nodding or shaking your head.** **09:06AM**

A Okay.

**Q And I'll try not to talk over you. If you let me finish my question before you attempt to answer it, I'll likewise try to do the same, let you get** **09:07AM**

**your answer completed before I ask the next question. If at any time you feel the need to take a break, as soon as we finish that question, we can and we'll do so, and if you have any questions at any time about my questions, if you don't understand it, then please let me know. I'll attempt to rephrase it and put it in a form that you can understand and will be able to answer correctly. Okay?**

A Could I ask you a question? Can I ask you a question to clarify? 09:07AM

**Q You can ask me if you want it clarified, yes, and I'll attempt to do that so that we are on the same page.**

A All right. 09:07AM

**Q And we get the meaning of the intended question and answer.**

A Okay.

**Q All right.**

MR. TUCKER: For video it might be awfully distracting. That bulb is flickering over Dr. Daniel's head. 09:07AM

MR. GARREN: They all are.

MR. TUCKER: Just the ones at that end.

MS. BRONSON: There's no way to only turn 09:08AM



those off.

A Unscrew it.

MR. BULLOCK: They're all those little 12-volt snap-ins.

**Q Does it bother you?** **09:08AM**

A Doesn't bother me.

MR. TUCKER: It's going to look funny on the video.

A Sometimes I'm bright and sometimes I'm not so bright. 09:08AM

**Q All right. Did you do anything today to prepare for your deposition? Before today did you do anything to prepare for your deposition today?**

A Yes. I tried to -- it's kind of like a PhD exam, if you don't know this, just don't show up, but I tried to look over some of the things that -- papers I've written, position papers, that sort of stuff. 09:08AM

**Q Okay. Did you meet with anybody in advance of preparing in anticipation of this deposition?** **09:09AM**

A I met with Friday -- actually it was Wednesday I met with Mr. Kincaid, the university lawyer, to basically ask, you know, the ground rules, that sort of stuff.

**Q Did you meet with anyone else?** **09:09AM**



A I met with my dean of agriculture, Mark Cochran, again just to ask for advice.

**Q All right. Did you meet with anybody from the poultry integrator defendants that have announced their position today?** **09:09AM**

A No.

**Q All right. Tell the court what is your current employment position.**

A I'm employed by the Crop, Soil and Environmental Science Department with the University of Arkansas. 09:09AM

**Q How long have you been in that position?**

A Since '89.

**Q Are you a tenured professor there?**

A Yes. 09:10AM

**Q Were you at any other position at the University of Arkansas before the crop, soil and environmental area?**

A No.

**Q Let's talk a little bit about your education starting with where you graduated from high school.** **09:10AM**

A I graduated from Academy High School in Little River-Academy, Texas. Graduated from A & M in 1963 and University of Wisconsin 1966 and then a PhD from University of Wisconsin in 1972. 09:10AM



**Q Okay, and your BS was in agronomy; correct?**

A Yes, sir.

**Q And your MS was in horticulture?**

A Yes, sir.

**Q And your PhD was in soil science; is that true?** **09:10AM**

A Minor in water chemistry.

**Q Let me hand you what's been marked as Exhibit No. 1, if you would, please, and I'll represent to you that I downloaded this document from the University of Arkansas website in October of this year. This biosketch, is this material you would have furnished to the University to publish on its website?** **09:11AM**

A Yes. 09:11AM

**Q I notice in the third page of this document it talks about your publications since '97. There are certain other publications prior to 1997 that you authored or co-authored; is that true?**

A Yes. 09:11AM

**Q And, likewise, there are probably other articles that are not listed on here that may be at a different time frame; is that true also?**

A Correct. This is not updated.

**Q Right. Do you have an updated list of all the** **09:11AM**

**articles that you've authored or co-authored available at any place?**
A Yes.
**Q So if we post deposition can obtain one from you, that would be okay?** **09:12AM**
A Yes.
**Q Let's talk a little bit -- during the deposition when I hand you an original exhibit, I'll ask you just to keep it in a pile in front of you and we can refer back and forth to it and the court reporter will pick it up afterward. Let's talk a little bit about your employment history then. Prior to 1989 when you went with the University of Arkansas, what was your employment history?** **09:12AM**
A From 1972 to '89 I worked for the University of Arkansas -- Wisconsin Department of Soils in basically the same position I'm in today. That's water quality and runoff, mostly dealing with dairies. 09:12AM
**Q Okay. So as soon as you completed your studies at University of Wisconsin, you were employed by them?** **09:13AM**
A Correct.
**Q Have there been any other positions of employment besides University of Wisconsin and the** **09:13AM**



**University of Arkansas then for you?**
A Not after the PhD.
**Q All right. Before your PhD, were there -- briefly describe what areas of employment you might have been in.** **09:13AM**
A Okay. Going back, graduating in a PhD in 1972, I was then a grad student from '68 to '72. I worked in Nigeria, Africa for two years on a contract with University of Wisconsin on an aid contract, and in '64 to '66 was a grad student in 09:13AM the horticulture department, and then interim time in the Air Force, and then I worked as a chemical rep for a year in Dallas from July of '64 to -- my dates are getting a little fuzzy here. I think I went in the Air Force in '64, but I worked as 09:14AM basically as a fertilizer rep, a chemical rep and then as an undergraduate student at A & M, graduated in 1963 and started in '59.
**Q Thank you. Tell the court, if you would, what kind of experience you might have in the area of bacteria, specifically dealing with poultry or livestock.** **09:14AM**
A Very limited. Have worked with bacteria. When we came here in '89, I started working with -- Dwayne Edwards is a young assistant professor in the 09:15AM



bio ag engineering, and we got a couple of grants, and I think we published something in '91 or '92 on bacteria. Very limited work.
**Q Do you do any work in the bacteria area today?**
A No. 09:15AM
**Q Are you familiar with the Arkansas Water Resource Center?**
A Yes.
**Q Can you tell the court what you know it to be or what it does?** **09:15AM**
A I think -- again, this is what my interpretation is. Basically it's a center which is common to all undergrad universities that receive federal funding for grants and promotion of protection of water resources and inventorying of 09:16AM water resources.
**Q Do you participate with AWRC in securing grants or participating in projects resulting from grants?**
A I did. We did at the time. Their funds have 09:16AM been diminished fairly significantly and they channeled their grants to young folks that need to start and not that this is -- their funding is limited.
**Q Okay. Do you know whether or not it receives** **09:16AM**



**funding from the poultry industry in doing any of its work or studies?**
A Not to my knowledge, no.
**Q Is the work or studies that are conducted at the AWRC, are they generally published?** **09:17AM**
A Yes. They are public records and you do have to file reports and a final report.
**Q Okay. When you say you have to file a final report or reports, where would that be filed?**
A Would be with Ralph Davis' office. 09:17AM
**Q And who is that?**
A He's the current director of the Water Resources Center.
**Q And you said those are public records available to anyone?** **09:17AM**
A Yes, best of my knowledge, yes.
**Q Okay. Does to your knowledge the AWRC present programs geared to the poultry industry and the effects of that industry on water quality?**
MR. McDANIEL: Object to the form. 09:17AM
A I'm sorry, what was --
**Q Let me clear up the ground rule. The lawyers will object periodically.**
A Okay.
**Q And after they do, they're simply doing that** **09:17AM**

**in order to make a Record, which can be reviewed at a later date by the court -- you will go ahead and try to answer the question, if you would.**
A Would you state it again, please?
**Q I'll try to do that. Does AWRC to your knowledge present programs geared for the poultry industry on dealing with defects in that industry on water quality?** 09:18AM
MR. McDANIEL: Object to the form.
A The way I interpret your question, no. Their responsibility is to present information, the science, not prejudice towards production or environment but just to basically state the facts. 09:18AM
**Q Okay, but in stating those facts, do they put on programs based upon those facts --** 09:18AM
A Yes.
**Q -- that might be beneficial, useful or available to the poultry industry?**
A Yes, of course, they do. If they put on symposia that relate and they have in the past related directly to the water quality issues, yes. 09:19AM
**Q Okay.**
A But, again, it is designed to provide information, not to support --
**Q I understand.** 09:19AM



A -- one way or the other.
**Q That's my point. They're reporting information; they're reporting facts or science, which could have beneficial needs or uses for the poultry industry or other industries that might affect water quality; is that a fair statement?** 09:19AM
A Yes.
**Q Have you ever contracted your services to a poultry integrator defendant or let me ask you this: I'll use the term poultry integrated company. Do you understand what that may be?** 09:19AM
A Yes.
**Q Okay. So it would refer to someone like a Tyson or Simmons or George's or Peterson; do you understand that?** 09:19AM
A Yes, sir.
**Q Okay, thank you. Have you been -- have you consulted with or contracted your services to any poultry integrated defendant in the last ten years?**
A No. 09:20AM
**Q So we're clear on the Record, have you been retained as an expert by any poultry integrator defendant in this case?**
A No.
**Q Okay. You attended a scientific meeting at** 09:20AM



**the University of Tulsa in 2005. Do you recall that meeting?**
A Yes, sir.
**Q And were you paid for your services in attending that function?** 09:20AM
A No. I haven't taken any money nor -- we've all made a point of not doing that because of the questions you're asking.
**Q And do you know whether or not the University received any compensation for your appearances?** 09:20AM
A Not to my knowledge, no.
**Q I want to go through a list of associations or companies or federations, if you will, and ask you if you know about them and what you know about them briefly. Are you familiar with an association called the Southeastern Poultry & Egg Association, now referred to as the U. S. Poultry & Egg Association?** 09:21AM
A Yes, sir.
**Q Tell me what you know about that association.** 09:21AM
A It's my understanding that they are a method of funding or from my standpoint of funding research that may be of interest to the industry.
**Q In the past, and I think we'll come in to look at a paper, but they've funded some work that you did years ago, did they not?** 09:21AM
A Yes, with Dwayne Edwards, yes.
**Q Okay. Are you familiar with the symposium referred to as the National Poultry Waste Symposium that's held every other year?** 09:21AM
A Yes.
**Q Have you attended one or more of those symposia?**
A Yes. I attended one when it was here in Springfield -- Springdale. I can't remember the date. It was I think in the fall of '96, '97. 09:22AM
**Q And did you present papers at that symposium?**
A I did.
**Q Is that the only one you attended?**
A That's right, yes, sir. I have no idea. I can't remember what the presentation was. Yes. 09:22AM
**Q The National Poultry Federation, do you have any familiarity or knowledge of that federation?**
A Vaguely. I really couldn't -- I just know it exists. 09:22AM
**Q All right. They've never funded any of your work or studies?**
A No.
**Q The National Chicken Council, are you familiar with that group or organization?** 09:22AM

A Not really, no.
**Q The National Turkey Federation, are you familiar with that group?**
A No.
**Q The Governor Clinton animal task force that was conducted in Arkansas, are you familiar with that?** 09:22AM
A Yes. That was going on about the time Dwayne and I started off.
**Q And did you participate in that in any way?** 09:23AM
A No.
**Q Directly or indirectly you did not participate?**
A No. I think the University had Lionel Barton as the representative, and he pretty much did it on his own. 09:23AM
**Q Are you familiar with a AWRC, Arkansas Water Resource Commission focus on phosphorus done in 1993?**
A Yes. 09:23AM
**Q Did you participate in that -- I'm not sure whether it's a symposium or exactly how that came about, but there was a publication that arose from that?**
A Surely I did. I mean, yes. I can't tell you 09:23AM



the details but surely I did. Is that the one that the book came out afterwards; is that the one you are referring to?
**Q I'm not sure which book you are referring to but they did publish a document called focus on phosphorus in 1993.** 09:24AM
A I think that's the book.
**Q Okay. Are you familiar with a study referred to as the Moores Creek study?**
A Yes. 09:24AM
**Q Did you participate or assist in that study?**
A Dwayne Edwards was the lead PI on it and I did participate.
**Q What did it study or what was the objectives of that study?** 09:24AM
A The objective of that study was to look at watersheds in Moores Creek and measure edge of field runoff and look at the effect of BMPs. Just a side comment, I was very skeptical about that project to begin with because you are monitoring natural runoff. I was involved in a project in Wisconsin, an EPA project, and it was -- it's just very difficult to monitor edge of field runoff, but luckily we got the runoff and we got the rainfall and it worked. 09:24AM 09:25AM



**Q Were there any poultry industry representatives participating in that study, if you recall?**
A No. I think that was funded directly from Arkansas Natural Resources Commission. 09:25AM
**Q The areas you would study the runoff, would that be from public lands or would it be from private lands?**
A Private lands. It would take a watershed, you know, a watershed of Moores Creek. 09:25AM
**Q And that, I assume, required the cooperation of various poultry farmers and growers?**
A Yes.
**Q Do you know whether or not the poultry integrators became involved in order to see that that cooperation was provided for the study?** 09:25AM
A Not to my knowledge. I think we worked with the county extension folks, and that's basically what we do, we work with the county extension. We actually was hired -- they hired an individual specifically for that, Billy Moore, and he worked with the growers, and we worked with Billy. 09:26AM
**Q The results of that study were published; correct?**
A Yes. 09:26AM



**Q And once they were published, they were available to the public?**
A Yes.
**Q And, likewise, they could have been available to any of the poultry integrator defendants; true?** 09:26AM
A Yes.
**Q Do you know whether or not they had poultry -- any poultry integrator had knowledge of the fact that the study was being conducted?**
MR. McDANIEL: Object to the form. 09:26AM
A I really don't know. I would assume they did because we had -- we had public meetings. I would assume they did. I don't know.
**Q Okay. The next one I want to ask you about is called the Beatty Branch Creek study. Are you familiar with that study?** 09:27AM
A I think that was part of the Moores Creek.
**Q All right. The next thing I want to ask you about generally is are you familiar with the Arkansas phosphorus index?** 09:27AM
A Yes.
**Q And tell me what involvement you have with that, if any. When I say have, or past tense have had.**
A It's being redone now, and the -- generally 09:27AM

the way these process works is that the -- bare with me. The index concept was developed in like '90, and a framework was set up for as an example of the index by Lemunyon and Gilbert, and then the states were charged with going back and developing their own index to fit their local conditions, and that's basically what occurred in every instance or in most instances the states would get all the people involved, the agencies, the scientists and start working on an index. 09:28AM

**Q Did you participate directly in that work for the State of Arkansas and its phosphorus index?**

A Yes, to a degree, yes.

**Q Tell me what your participation or involvement or contribution was. 09:28AM**

A Well, I mean Dwayne Edwards and I had published quite a bit of work at that time relating to runoff and chicken litter and swine, and it was use of that or the use of that information.

**Q When you say the use of that information, would they have used that which was published or did they secure raw data and organize, use it in a different manner, if you know? 09:29AM**

A Generally what is done is -- just, for instance, I think Jeff Nichols and I published some 09:29AM



work on incorporating litter and not incorporating it, and it would be that information put into an index and like formulating the risk factors in application, land application.

**Q When you say incorporating litter, are you talking about land incorporation or -- 09:29AM**

A Yes, excuse me, yes.

**Q Actual like tilling it in, that sort of thing?**

A Yes.

**Q Okay. Tell the court, if you would, what areas you may be working on currently or any studies you might be conducting. 09:29AM**

A We are -- we are looking at, again, back to evaluating edge of field runoff, and we have a watershed project that we are conducting that's 09:30AM funded by the Arkansas Water Resources Commission and it's just looking at, again, trying to quantify what may be natural background levels, what are some of the effects of haying and grazing, that sort of stuff. 09:30AM

**Q Is there an area in which you are doing that work geographically?**

A Yes. It's on the University of Arkansas experiment station farms in Savoy and out on Weddington Road. 09:30AM



**Q When you said earlier that the API, the Arkansas phosphorus index, was being redone, who is working on that, if you know?**

A Well, it's a group of the folks, again, including the Arkansas Natural Resources 09:31AM Conservation Service, that's federal, the state Arkansas commission. There's University folks, the extension. Generally anyone that has expertise in the area.

**Q Is -- do you contemplate that your current work that you're doing with quantifying background and edge of field work at Savoy to be utilized for part of the redoing, if you will, of the phosphorus index? 09:31AM**

A It could if we were to get some runoff. We're 09:31AM having the same problems. We're not getting runoff.

**Q Not enough rain?**

A It's dry. We're about seven inches below normal.

**Q Is there any other projects -- are there any other projects that you're working on besides the one you just described? 09:32AM**

A Well, we have some good ideas but sometimes they don't get funded. I just talked to Pinion, our soybean breeder, and we've been trying to get a 09:32AM



project funded where he's breeding low phytic acid soybeans that's ultimately best management practice. Didn't get funded. He was thinking about going back to the Southeastern Poultry Federation, but nothing of any substance. 09:32AM

**Q All right. Do you contemplate when your project that you are working on, edge of field and experiments at Savoy, to be completed?**

A We'll be done by September of '08.

**Q After it's done, how long does it take before that material would be published? 09:32AM**

A If we get anything out of it, it would be -- you know, you would submit it. It would probably take at least two years but I think that information is available, public record. 09:33AM

**Q So the information that might result in the publication is still available publicly?**

A Sure, sure.

**Q I'm going to change and talk about some different subject matters, and I've noticed in several of your articles you've talked about common practices in the poultry industry, and I'd like to ask you what have you done to educate yourself about the traditional methods of poultry farming, poultry growing? 09:33AM**

A I've mostly talked to growers that are involved in the day-to-day operation.
**Q Did any of -- talking to growers, does that involve solely within the state of Arkansas or was it elsewhere, too, that you did that work?** 09:34AM
A Well, I would say probably other places. We would go to conferences. We might talk to the extension specialists for poultry in Georgia or Alabama.
**Q Poultry is pretty big in the Georgia area, is it not, and Alabama?** 09:34AM
A Yeah, yes.
**Q Over what period of time would you say that you've conducted this kind of survey or discussions with growers involving their practices?** 09:34AM
A Well, it's been ongoing since August of '89 and, you know, that changes.
**Q Sometimes more often than not? I mean when you say changes, you might be more involved doing it than other times?** 09:34AM
A No. I mean the practices do change and you have to try and keep up.
**Q Let me ask you then about the practice of removing the poultry waste and litter from the barn. What generally has been the practice of dealing with** 09:35AM



**that poultry waste generated at the barn?**
A It's generally cleaned out once a year.
**Q When it's cleaned out, what usually becomes of it?**
A It's land applied. 09:35AM
**Q And when you say land applied, it's spread on land. It's my understanding it's generally not incorporated when it's spread; is that true?**
A It is not incorporated at the present time generally, common practice. 09:35AM
**Q And that's been the common practice in the past; correct?**
A Yes.
**Q Based on your experience and knowledge, how long has spreading poultry waste when it's removed from the barns been done by the poultry growers?** 09:35AM
A Well, certainly to my knowledge since '89, and I'm told that it's occurred prior to that as a fertilizer for the pasture and also been told that prior to that, the soils were very infertile, and 09:36AM this was a good practice that the growers liked and that's how the cow-calf operation became so prevalent in northwest Arkansas.
**Q In your educating yourself with regard to common practice in the poultry industry, did you** 09:36AM



**have any discussions or meetings with any of the integrator representatives as opposed to the growers?**
A Surely we did. I remember we used to work with -- a bit with Claude Rutherford and, yes, I 09:36AM would say as convenient.
**Q Was Claude Rutherford at the symposium, the National Waste Symposium that you also presented at; do you recall; was that the same period or it might have been a different --** 09:37AM
A I would think it is the same period but I'm not sure about that.
**Q I'm going to change subjects on you again and ask you if you are familiar with a gentleman by the name of Martin Maner?** 09:37AM
A Yes.
**Q How long have you known Mr. Maner? Let me ask you, have you known Mr. Maner personally?**
A Yes. I've known of him probably fairly soon after we came here. He was the DEQ rep in this 09:37AM region and then went to Little Rock and then moved up within his agency.
**Q And so when you say when you first came here, we're talking about -- was it the early '80's?**
A '89, August of '89. 09:37AM



**Q All right, and how did you come to know him or associate at any time with him?**
A Well, it's kind of like a good professional with a bad professional. You need to know who the stakeholders are, and DEQ certainly is a stakeholder 09:38AM in this whole issue, and during the process I think he was a permit writer when he was here in this region, and my past grad student was a permit writer, so we just need to know what they need and how best we can play a role in what they do. 09:38AM
**Q And those permits would be water permits or discharge permits?**
A Yeah, particularly for in this case would be for swine operations that were liquid.
**Q In your working with him, around him and with others in the industry, can you describe what reputation Mr. Maner has in the industry of water quality?** 09:38AM
A Well, seems to me -- I mean I always had a lot of respect for him. He was always a straight 09:39AM shooter. When he had to -- very credible.
**Q Let me hand you what's been marked as Exhibit No. 2 and go ahead and take a minute to look at that and I'll ask you whether or not you've seen this before.** 09:39AM

A It doesn't ring a bell. It doesn't mean I haven't seen it but not that I know of.
**Q It's dated March of 1988, so it has some age to it.**
A Yeah. I didn't get here until 1989. 09:40AM
**Q Right. I'm going to ask you about a couple of statements. This is a document authored by Mr. Maner and I'll ask you about a couple of statements he makes in this time frame and see if you have an opinion about them. In the second paragraph it leads off with the first sentence in that paragraph, Benton and part of Washington County are largely underlain by fractured limestone of the Boone Formation. Is that a true statement as far as you know? 09:40AM**
A I'm not a geologist but I've heard that stated before.
**Q Are you familiar with what kind of soils are in that Boone Formation?**
A I should be. Generally, yes. 09:40AM
**Q Are those -- he says here the soils overlying the Boone are moderately to excessively well drained. Is that your understanding?**
A I would guess that's probably right, yes. I mean that's a pretty broad statement, and you can 09:41AM



find out by going to the soil survey. For each soil like a Captina, it could say well drained.
**Q And so identify the name of the soil?**
A Uh-huh.
**Q And see its characteristics? 09:41AM**
A There would be lots of different soils in those formations.
**Q Correct. When it says well drained, what does that mean in soil terms?**
A To me it would mean that as opposed to a soil 09:41AM let's say in the Delta region of Stuttgart, which would receive an inch of rainfall, maybe 90 percent of it would run off, and one on the Captina on a well drained soil, you would have infiltration and less runoff. 09:41AM
**Q Is leaching another term for what you just said, infiltration?**
A Yes, could be.
**Q And Captina, that's a soil type --**
A Yes.
**Q -- that's been characterized, and that's one of those type in this area, Benton and Washington County; is that true?**
A I'm assuming, yes. Just let me make sure. There's soil surveys of Benton and Washington 09:42AM



County. You can go to any particular field. The counties have been mapped. You can identify that -- you can tell what soil is right here and then decide -- go to that manual and decide -- and tell whether it's well drained or non-well drained. 09:42AM
**Q In fact, many times you'll -- let me ask you this: Are you familiar with animal waste management plans?**
A Yes, or nutrient management.
**Q Nutrient management plans is another term you use? 09:42AM**
A Yes.
**Q Have you seen those that show the soil characteristics within the plan and describe the nature of those soils? 09:42AM**
A I have seen the plans. I assume they would describe the soils. I wouldn't --
**Q Don't remember off --**
A Don't remember, no.
**Q Okay. Mr. Maner in the same paragraph goes on to say, because of these features, the ones we've just discussed, rainfall percolates readily through the soil and into the shallow groundwater aquifer. That's infiltration that you described in your testimony earlier. Is that essentially what we're 09:43AM**



**talking about here?**
A That's what he says, yes.
**Q All right. He there goes on to say, therefore, soluble materials placed on the surface enter the groundwater with relative ease. Again, 09:43AM what he's saying here, and correct me if I'm wrong, it's the infiltration that goes from the surface into the groundwater. That groundwater is water that is essentially below the ground in some kind of alluvial or some other formation; is that a fair 09:43AM statement?**
MR. McDANIEL: Object to form.
MR. GEORGE: Object to the form.
MR. McDANIEL: Can we have a stipulation that objection by one defendant is good as to all 09:44AM defendants?
MR. GARREN: Yeah.
MR. McDANIEL: Okay.
MR. BULLOCK: That way they don't have to sing in harmony. 09:44AM
MR. McDANIEL: We may sing in harmony, but it will alleviate other counsel feeling the need to have to join on the Record.
A Would you restate that, sir?
**Q I'll try to. The last sentence of this 09:44AM**

**paragraph where he says, therefore, soluble materials placed on the surface enter the groundwater with relative ease, and what I'm trying to establish is that -- first, let me ask you this: What is meant by the term groundwater as you might understand it in this sentence?** 09:44AM

A Well, when I say groundwater, I think of the actual depth of which there is permanent water. Like you drill a well and that's the groundwater. Apparently you will hit perched groundwater, perched 09:44AM situations in these soils up here. I would say that, you know, there's a lot of data that's gone on since '89. That's 20 years. Overall I would say Mr. Maner's statement there is true, but it's not a -- it is not a straight conduit. There are many 09:45AM things that happen with compounds they put on the surface and as they move through the soil profile, there's absorption, adsorption, that sort of thing, and it's not like you put out Atrazine on the surface and you're going to see Atrazine, a 09:45AM herbicide, in the groundwater at high concentrations as you had put them out.

**Q Okay. That's not something he's talking about in this paper apparently?**

A No, no. Sorry. Soluble -- put out phosphorus, 09:45AM



A We know it to be true to some extent. I think Ken Steele in the Water Resources Center did a study -- very hard to prove -- did a study where he looked at areas that were pristine and areas that were impacted by land application of litter and showed an 09:47AM increase of nitrate in the well water of two to three part per million, below the ten part per million limit.

**Q Let me hand you another article.**

A Are we through with that one? 09:48AM

**Q Yeah. We'll probably come back to it.**

A Sure.

**Q In the meantime, I want to talk about this one that's Exhibit 3 on the same subject. This is a document that shows you and D. R. Edwards -- that's 09:48AM Dwayne Edwards again; is that correct?**

A Yes, sir.

**Q Published through the Arkansas Water Resource Center. Do you know -- I think this was published June of '91 I see on the second page. 09:48AM**

A Uh-huh.

**Q If you look at Page 6 of the document, which is the introduction, about halfway down on the right-hand side of the paragraph it starts, the potential for water quality degradation from 09:49AM**



same thing. As a matter of fact, I would say probably in terms of phosphorus, that would be an over simplification of what would happen to phosphorus.

**Q The eventual result is that even phosphorus 09:46AM when applied to the surface in this area that we're talking about can and generally will enter the groundwater in some form, does it not?**

MR. GEORGE: Object to the form.

MR. McDANIEL: Object to the form. 09:46AM

A I think that is an over simplification. I think that -- if you picked another soluble nutrient, that would be the case, but phosphorus is very unlikely to enter the groundwater. All the data we see is the phosphorus content in actual 09:47AM groundwater, you can't -- you really can't say it's elevated due to --

**Q Let's talk about nitrogen.**

A It's nitrate.

**Q Nitrates. You're going to see nitrates doing 09:47AM what he is describing, doing what Mr. Maner describes here; as a soluble material on the surface, it will enter the groundwater; we know that to be true, do we not?**

MR. McDANIEL: Object to the form. 09:47AM



**eutrophying nutrients, parens, nitrogen and phosphorus, end of parens, oxygen-demanding materials, parens, organic carbon, end of parens, pesticides and selected metals is particularly high, 09:49AM especially in areas such as northwest Arkansas where shallow, cherty soils and karstic geology greatly increase interaction between surface and groundwater. This is essentially what we're talking about, is it not?**

A Uh-huh. 09:49AM

**Q Is the cherty soil, is that a description different than Captina or is that a generalized description, if you would?**

A I think most of the soils we see here would be called cherty. I don't know what the NRCS calls it, 09:50AM but basically it's got rocks in it. That's why you don't incorporate it.

**Q And that's what I was going to ask you to tell the court. What does cherty mean in soil terms?**

A Rocky. 09:50AM

**Q All right. I'm going to move back to the Exhibit 2 then. We'll probably come back to this in a moment. Before I do, and I apologize for skipping around, is the statement you made in 1991 in that Exhibit 3 that we just read, is your opinion the 09:50AM**

**same today?**
A We've done quite a bit of work on the groundwater -- not the groundwater, the movement of solids through the bathyl zone, and that's the area between the surface and where there's actual 09:51AM
groundwater, and I think this Exhibit 3 may have been in support of the project that we -- that Dwayne and I had with national funding, looking at when you apply the material on the surface, what are you going to see, and I would say it is modified to 09:51AM
some extent, modified to the -- to put it in context, you certainly will see movement of the soluble compounds like nitrate chloride, and we were able to see those at various depths in the soil profile. I forget what the nitrate content was but 09:52AM
I'd say it's not a pipe to the groundwater.
**Q Let me ask you this: When you said the term materials are applied, you're talking about fecal waste material; correct?**
A The litter or any material that's applied. 09:52AM
**Q And when you say litter, do you mean the feces, urine and bedding material that's associated with it --**
A Yes.
**Q -- in a growing barn? 09:52AM**

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A Yes.
**Q And as one of the materials that passes through, is soluble phosphorus one of those materials?**
A Soluble phosphorus is a potential material 09:52AM
because of its chemistry nature. It does not move -- won't say it won't move but it does not move as readily as something like nitrate, which is very mobile.
**Q And when you say as readily, it may move but 09:52AM at a slower pace but eventually it does move?**
A I think to my knowledge soluble phosphorus has not been detected in groundwater because of its orphan capacity of the profile of the soil. It -- on the other hand, nitrates and chlorides have been 09:53AM
detected.
**Q So generally speaking the risk with phosphorus, as I understand what you are telling me now, is the surface runoff?**
A Yes, sir. Now, just to clarify, there are 09:53AM
situations where phosphorus is -- can be a problem but they're not here. They're in like in the Midwest where you have tile drainage. You have tile drainage three or four below, and that's a short distance. 09:53AM

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**Q And phosphorus in those areas might in fact get to the groundwater more readily as a result of that structure?**
A Yes. Well, they will get to that tile drain.
**Q Yes, sir. 09:54AM**
A But generally phosphorus is not thought of as being a major contaminant of surface water and, again, there are instances, the Delmarva Peninsula, places like that where that does occur.
**Q And the knowledge of that in the Delmarva area 09:54AM goes back some time, doesn't it? Do you recall when that first became aware in academia about those issues? I'm testing you here. If you don't remember, that's fine. It's documented. We know, do we not? 09:54AM**
A Yes. I think Tom Simms and others probably in the late, early to '90's -- early '90's documented that. I mean when you have groundwater surfacing on the surface of the soil in wet conditions, you're going to -- you got some problems. 09:55AM
**Q I'm going to go back to Mr. Maner's article again or paper there and ask you a few more things. First off, are you aware of any literature or studies calculating the nitrogen or phosphorus loading to either or both of these Arkansas 09:55AM**

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**counties, Washington and Benton?**
A Let me see if I understand your question. You're asking if I know what the application rate is?
**Q No, no. Are you just aware, are there studies 09:55AM that deal with the calculation of either nitrogen or phosphorus loading that may occur in Arkansas, specifically Benton or Washington County area?**
MR. McDANIEL: Object to the form.
A I'm still not clear what you mean by loading. 09:55AM
Do you mean what's being applied or what's coming off?
**Q Coming off that would get into the water?**
MR. McDANIEL: Object to the form.
A Edge of field stuff. 09:56AM
**Q That sort of thing.**
A Well, studies like the Moores Creek do develop loadings but they're very limited and very expensive to do. There are some, yes.
**Q Okay. 09:56AM**
A Very few.
**Q Have you seen -- well, let me ask you to look at Mr. Maner's paper under the heading where it says manure and nutrients generated. If you would read the first paragraph and when you have completed, let 09:56AM**

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**me know and we'll talk about it.**
A Okay. This evaluation indicates that approximately 30 million pounds of manure were excreted daily in the two county areas. Of this, about 250,000 -- 257,000 pounds per day were 09:56AM
nitrogen and 87,400 pounds per day were phosphorus. In terms of the human population equivalent, based on typical domestic wastewater values, these values were equal to a population of 8 million people. Since production has been expanded, current rates 09:57AM
are expected to be higher.
**Q Now, are you familiar with any information that would contradict the statement made in this paragraph?**
MR. McDANIEL: Object to the form. 09:57AM
A Not to my knowledge, but let me just make a comment on that. When we're -- in essence, you see these extrapolations from this particular waste to a human population. Generally what we're treating human population for are BODs and CO -- biologic 09:57AM
oxygen demand and different parameters, and unfortunately phosphorus is a part of that. It's not why you are treating it, though. It may be now but it's not then, but generally I think you can make those extrapolations but they're done based on, 09:57AM



you know, on --
**Q I'll ask you to look now then at Page 3 of this document under the water quality effects section. It references that article there, groundwater -- 09:58AM**
A Which one are we on?
**Q In Exhibit 2.**
A Sorry, excuse me.
**Q Page 3, under water quality effects, the second paragraph. It references an article there 09:58AM**
**from the Arkansas Water Resource Center Publication No. 129, land use effects on groundwater quality --**
A Hold on just a second.
**Q On the third page of that.**
A Sorry, third page. I can actually count. 09:58AM
**Q There you go. I apologize.**
A No. My fault.
**Q I was just -- if you would read that first portion of the second paragraph and ask you if you are familiar with this particular publication. 09:58AM**
A Let's see. You are talking about the --
**Q Water Resources Publication No. 129 and the title there 1987.**
A Land use effects on groundwater quality and carbonate rock terrain, I'm not familiar with that 09:59AM



one, '87.
**Q All right. Let me ask you, the last sentence of that paragraph reads, correlation of nutrients with sodium and chloride concentrations in water samples suggested the nitrate source is animal waste 09:59AM**
**as opposed to commercial fertilizer. Do you believe that is -- that's a true statement, you can do that?**
A It's out of my area.
**Q If you don't know --**
A It's circumstantial, you know, it's 09:59AM
circumstantial.
**Q Do you know whether or not nitrates are significantly higher in areas receiving animal waste to the land?**
A I think about the only study that really 10:00AM
showed that was Ken Steele's publication. This may be the one that showed that it was like in background levels, springs was one part per million nitrate and areas that were identified as land applying areas were one to two parts per million. 10:00AM
**Q Greater?**
A Yes.
**Q Yes, sir, thank you. We've got a warning here of a tape running out and this is probably a good place to stop. We'll take a five-minute break or 10:00AM**



**whatever and let him change the tape and come back.**
VIDEOGRAPHER: We're now off the Record. The time is 10:01 a.m.
(Following a short recess at 10:00 a.m., proceedings continued on the Record at 10:11 a.m.)
VIDEOGRAPHER: We are back on the Record. The time is 10:11 a.m.
**Q Dr. Daniel, I'm going to hand you now Exhibit No. 4 and ask you to look at that document. This is 10:11AM**
**one of your papers again.**
A Uh-huh.
**Q Do you remember or are you familiar with that document?**
A I remember it. I'm not familiar with it but I 10:12AM
remember writing it, yes.
**Q This was published in May, June of 1995 in the Journal of Soil & Water Conservation; correct?**
A Yes.
**Q I'm going to ask you about a couple of 10:12AM**
**statements within this article and the first one I would direct your attention to would be in the first paragraph, the second sentence, and I'll go ahead and read it. It says, rapid and concentrated growth of the poultry industry in several states, however, 10:12AM**

**increased the concern about disposing of poultry waste with respect to non-point source pollution. Let me ask you, to your knowledge does that include the area of northwest Arkansas and northeast Oklahoma?** 10:13AM

A Yes.

**Q You're familiar, I assume, are you not, with the Illinois River watershed and its general boundaries?**

A Yes. 10:13AM

**Q This document also says that nitrate leaching into the groundwater, non-point source phosphorus runoff into surface water bodies and release of pathogenic microorganisms are three of the main problems encountered with improper management of** 10:13AM **this resource. The reference to resource there is the poultry litter or waste being land applied, is it not?**

A Yes.

**Q Is that still your opinion today?** 10:14AM

A Let's see. It's pretty close. The text is where?

**Q It's further down in that same paragraph.**

A Okay. Nitrate leaching into the groundwater, non-point source phosphorous runoff into surface -- 10:14AM



release of pathogenic microorganisms -- I would think so, yes.

**Q Tell the court, if you would, what you mean by pathogenic microorganisms.**

A Well, I think -- what I think is implied there 10:14AM is those organisms that -- again, I'm not a microbiologist -- Escherichia coli and fecal coliform and those sort of organisms.

**Q Are those organisms known to create risk to the environment?** 10:15AM

MR. McDANIEL: Object to the form.

A Again, I'm not a microbiologist, but my understanding that like swimming -- I don't know -- sometimes it's banned in Beaver Lake and some of the water bodies, and it's due to the presence of these 10:15AM organisms.

**Q The ones you just described, E. coli and fecal coliform and maybe others?**

A And probably others. It again -- difficult to show cause and effect. You know, our microbiologist 10:15AM tells us that many times these result from geese, wildlife.

**Q And I'm not asking about the sourcing of this.**

A Excuse me.

**Q I'm just asking about the fact that the** 10:15AM



**pathogenic microorganisms you're referring to here are those such as E. coli and fecal coliform. Those type of organisms are found in poultry waste, are they not?**

A Yes. 10:16AM

**Q This goes on to say in the very last sentence in that column, since the agronomic value of poultry litter is well known and has been thoroughly documented in numerous publications, the main issues addressed in this paper are environmental rather** 10:16AM **than agronomic, and you cite some other people there who have documented the agronomic value of poultry litter. Can you tell the court what you mean by that, what its agronomic value is?**

A Poultry litter, as you described it earlier, 10:16AM is an excellent fertilizer. It has a very low seed-in ratio. It has a high amount of organic matter. It's excellent fertilizer.

**Q These reports that are -- I'm sorry, the authors of reports that supposedly document this in** 10:17AM **your publication don't have a date on them. What period of time are we talking about that this is well known and well documented; can you give me a rough estimate?**

A Certainly. 10:17AM



**Q This was published in '95, the one we are looking at, Exhibit 4.**

A Let's take one there. Wilkinson was '79 and '90. I mean these are -- doesn't take a rocket scientist to figure out this is good fertilizer. 10:17AM When you put it out, it's obvious where you put litter and where you haven't.

**Q At Page 322 you point out that litter is removed after five grow-outs and that it says currently litter is removed after five grow-outs,** 10:18AM **which is once a year. Upon removal, this material may be directly land applied or temporarily stored. Let me ask you this: Do you know whether or not once it's removed, that the poultry waste, poultry litter has any use in the growing of the poultry** 10:18AM **thereafter?**

A Not to my knowledge, no.

**Q That's in part why it's being spread on the land, is it not?**

A Yes. 10:18AM

**Q Under the heading land application manure, you talk about except for small amounts of poultry manure used in animal feed, the major portion, greater than 90 percent, is applied to agricultural land. That's the customary practice that I think we** 10:19AM

**talked about earlier; is that correct?**
A Of land applying it?
**Q Yes, sir.**
A Yes. Go ahead.
**Q And when you're talking about it in this article, are you referencing a specific area or is that just generally true?** 10:19AM
A I think we're implying that it's generally true nationwide, not only for litter but for the animal waste.
**Q All right.**
A And I will point out that using poultry manure as animal feed is no longer practiced.
**Q Okay. It was tried and used for a while, wasn't it?** 10:19AM
A Apparently.
**Q All right. You go on to say in the same article at the same place, this application, referring to the land application of the poultry waste, usually occurs no more than a few miles from where it's produced. I think further down it says under transportation, it's usually restricted to six to twelve miles. Did you gain that information from your discussions with those in the industry that you talked about earlier?** 10:19AM 10:20AM



A Yes. It's generally -- excuse me -- from talking to growers. I think there have been some studies, surveys done.
**Q Generally speaking can you tell me why it's limited to the six to twelve miles we're talking about moving it?** 10:20AM
A Well, it's some degree of a physical thing. Poultry litter is a very bulky material, bulk density of about one, point one, point five, and it is cost of transport. I think there's studies today that would say that litter is worth about 30 or $40 and you can afford to transport it about 30 or 40 miles. 10:20AM
**Q In 1995 you're reporting it was limited to as much as six to twelve miles; correct?** 10:21AM
A Yes.
**Q When you use the term poultry waste or poultry litter in this article and others, does that include the waste generated from broiler chickens?**
A Yes. 10:21AM
**Q Does it include the waste generated from layers?**
A We probably refer mostly to litter from broiler chickens and very limited layer operations. That's liquid material or have been. 10:21AM



**Q Yes, and then would it -- would that term poultry litter or poultry waste refer to that produced by poults?**
A If it has bedding and -- yes.
**Q And, likewise, would that term poultry waste or poultry litter include turkeys?** 10:21AM
A Yes.
**Q In the second column of this same page at the top of the first paragraph, I'll read it so you can find it. It says, runoff of dissolved P -- that means phosphorus, does it not?** 10:22AM
A Yes.
**Q From fields receiving poultry litter can occur even when best management practices, BMPs, are utilized. Is that still your opinion today?** 10:22AM
A You will -- yes.
**Q Okay. I can finish that paragraph so it brings it into context. It says this is because poultry litter contains high concentrations of water soluble P, often in excess of 2,000 milligrams or kilogram to the one power. This fraction is readily transported in runoff water during intense rainfall events. That's essentially how you're saying phosphorus, soluble P gets into the water source. Is that a fair statement?** 10:22AM 10:23AM



MR. McDANIEL: Object to the form.
A Yes. I mean if you didn't have runoff, it wouldn't -- water is a transport mechanism, yes.
**Q In this article you speak to using composting and I would -- this may not be in your area, so if it isn't, just tell me. Do you know how long it takes when you refer to this thermophylic zone that is to compost and kill the microorganisms that are within the waste; are you familiar with that at all?** 10:23AM
A I don't know all the details, but probably within weeks or months. 10:24AM
**Q Okay, and -- but you go on to say in the bottom of the second column, however, composting is probably not cost effective with respect to agricultural usage of poultry manure since it's a time consuming, costly method resulting in an end product that is not any higher in nutrients than fresh litter. Let's talk a little bit. What do you mean by it's not any higher in nutrients than fresh litter?** 10:24AM
A Well, basically you might alter that some because what happens in composting is that you are driving off the carbon; you are reducing the amount of carbon in the decomposition process. So your analysis would be -- you may start with 2,000 10:24AM

pounds. After composting it may be down to 1,200 pounds. So you are reducing the volume and the phosphorus is not -- you haven't lost any phosphorus, so its concentration is going to be higher and it will be generally higher in water soluble P.

**Q And, likewise, the nitrogen will probably be less as a result of longer volatization and that sort of thing?**

A Could be. Now, you have -- if you let the pH get above a certain level, it could go off, yes.

**Q Generally and tell me if -- let me just say it this way: Generally poultry waste litter is applied for its nitrogen value by farmers, is it not?**

MR. McDANIEL: Object to the form.

**Q They're looking for nitrogen to grow grass; is that a fair statement?**

MR. McDANIEL: Object to the form.

A I would say that it is applied for its nutrient value, both N and P and potassium, but generally it had been applied to meet the nitrogen needs of the crop. In other words, that's how the rate was determined.

**Q Okay. Tell the court what you mean.**

A Okay.



**Q You sample the waste and it tells you what the N, P, K, nitrogen, phosphorus, potassium levels are; correct?**

A Right.

**Q Do you use that then to -- then you know what you are applying; is that a correct statement?**

A Correct, yes.

**Q And so if you know you need from a soil sample so many pounds of nitrogen, you're trying to put the amount of waste that contains that amount of nitrogen on your field when you apply it; is that what you meant then?**

MR. McDANIEL: Object to the form.

A Yes, yes.

**Q Okay. Going to Page 323 of the same Exhibit 4, in the first column in the second paragraph it starts out, at present vertical integrators prescribe most of the feed, water, medication, housing, light, heat, ventilation and harvesting requirements for contract growers to raise poultry. Is that information you learned when you spoke with growers when you interviewed growers as you said you did?**

A I think in combination with probably talking to extension specialists that -- like Lionel Barton, Susan Watkins. We listen to anybody.

**Q All right. Did you ever have an opportunity to look at a contract that a grower may have?**

A No.

**Q The last part of that paragraph you state, if the integrators were to get more involved with manure management, it would probably be more helpful in solving any of our metal problems than governmental regulation and/or subsidies. You opined that in 1995. Do you still have that opinion today?**

A Yes.

**Q What would the involvement -- what do you suggest would be the involvement of the poultry integrators in the manure management?**

A Well, I think anybody -- in dealing with manure, like anything else, you have to involve the stakeholders, not only the people that's going to be affected but the integrators. In that context, I realize many times this is easier said than done because these are proprietary management schemes that they use or competitive. Just like using a best management practice. Something like low phytic acid corn, which you may or may not be -- are you familiar with what that means?



**Q No.**

A Okay. Most of the phosphorus that we get in the feed, almost 90 percent of it, is in a form that's unavailable to the animal, to the monogastric animal. It's there. The percentage-wise may be, you know, whatever they're using, but it's not available to the animal. It passes directly out of the -- through the gut into the manure. Great best management practices are to grow corn that is low in that phytic acid and -- or use phytase, which is an enzyme. These alone, it's been estimated you can reduce the phosphorus level by 50 percent.

**Q Are there other issues with phytase that have been discovered or discussed today that weren't known several years ago?**

A Sure. That's an evolving science and more studies are done. Some -- yes.

**Q And what is the current thinking actually today then of the actual use of phytase; has that changed?**

MR. McDANIEL: Object to the form.

A Well, it's been an issue that some scientists will say that you actually -- you will reduce the total P in the litter and in the diet and increase the water soluble P. Others have shown that that's

not the case, and I think one of the best experts around is the gentleman from Georgia, and I cannot think of his name, he's a South African, and basically he says it depends how you manage it.

**Q Let's go back to this statement again about manure management and getting integrators more involved. Besides the example of perhaps adjusting the feed to the bird, are there other areas that you might suggest would result in manure management that the integrators could get involved with?** 10:30AM 10:31AM

A Oh, I think you could -- you know, you could think of several. Again, it's an issue of realizing how competitive the industry is, knowing what's in the feed, being able to take out the phosphorus there that's added as a result. Probably in the process of developing and implementing nutrient management plans, they're the ones that has the most contact with the growers than anyone else. 10:31AM

**Q Would simply removing it from land application in this -- in a nutrient limited watershed be one of those suggested areas where integrators could be involved?** 10:32AM

MR. McDANIEL: Object to the form.

A I'm not sure what you're asking me. Are you saying -- ask me again what you are -- 10:32AM



**Q By controlling the waste application and removing excess poultry litter from areas of nutrient limited watersheds so that it isn't land applied?**

MR. McDANIEL: Object to the form. 10:32AM

A That would solve the problem. That would solve one problem.

**Q One thing I notice is that you make this recommendation here. You skip over to the last page of this paper at 327. That's not one of the recommendations that you've listed at the end of this paper. Can you tell me why?** 10:32AM

A What now?

**Q The recommendation I'm referring to is that integrators be more involved with manure management. If you read the recommendations on Page 327, that's not one of them. Why would that be?** 10:33AM

A Well, I mean we've looked at the litter as a resource, as a symbiotic relationship between the chicken grower and the cow-calf operation, and so we -- and just like such, we feel like it is a resource that shouldn't be landfilled. It just needs to be used properly. 10:33AM

**Q And that's my next question and, that is, the over application generally of anything can result in some kind of harm, can't it?** 10:33AM



MR. McDANIEL: Object to the form.

**Q That's probably not a fair question because it's so broad. Certainly the over application of poultry waste can lead to risk of harm to the environment and humans; would you agree?** 10:33AM

MR. GEORGE: Object to the form.

A Yes. You would have to define what is over application.

**Q We're going to talk about that.** 10:34AM

A I bet.

**Q In your work in this area and certainly with regard to the practices of the industry and your knowledge of the Illinois River watershed, is the grain that's fed to these birds, is it all grown within the watershed?** 10:34AM

A No. I shouldn't say that, but my understanding is that there's absolutely minimal amount of crop land in the Illinois River watershed.

**Q So when we see corn that has phosphorus in it, soy that has phosphorus in it and perhaps other elements of the feed, it's being brought in or imported into the watershed when being fed to these birds, is it not?** 10:34AM

A Yes. 10:34AM



**Q Back at Page 323 of the same document, in the lower right-hand corner down near the bottom there it says, in addition, poultry manure can provide plant available nitrogen and phosphorus for several years after application. Tell me what that means and how that works.** 10:35AM

A Okay. I would think what we are referring to there is basically all of that material, nitrogen is not in available form, and over the period of -- so much is inorganic regulated form. Others is tied up in organic matter and requires decomposition for it to be available, slow release fertilizer. 10:35AM

**Q And that was my next question. That's essentially what you have is a slow release, is it not, of these -- of nitrogen and phosphorus?** 10:36AM

A Correct.

**Q I think I've read in maybe some of the other papers, and we may get to it later, it can take decades to remove these elements, constituents, if there is not the removal of the crop. If the crop stays there or the cattle eat and then simply digest it and redeposit it, is it correct in saying that it can take it decades to remove these from the soil?** 10:36AM

A If you are referring to phosphorus and that phosphorus level in the soil is built up, yes. 10:36AM

**Q Okay. Let's turn to Page 324. I want to ask you if you have any recollection of the source of your information in the statement. It's talking about composted poultry litter in the first column midway down, essentially the third paragraph, and you say it's also sold to nurseries and garden stores as an organic amendment. Then you go on to say, however, at present the amounts sold in this manner represent much less than 1 percent of the total litter produced. Did you in fact survey or obtain data to support that statement?** 10:37AM

A No. We didn't reference anything there. That's a --

**Q So it's an estimate then?**

A It's not much even now. 10:37AM

**Q Even today -- that was going to be my next question. Even today, you don't see much of this going out into a composted poultry litter sold in nurseries?**

A Not that I know of, I mean -- 10:37AM

**Q And when we say -- when you make that statement, we're talking about the area that would also include the Illinois River watershed; is that correct?**

A Yes. 10:38AM



**Q On Page 325 there is the statement that I think I referred to earlier, and that was the shallow and cherty soils and karstic geology. Do you remember our discussing about that --**

A Yes. 10:38AM

**Q -- an interaction between surface and groundwater? Do you know, sir, whether or not bacteria can travel to the groundwater; are you familiar with that as a fact or studies that deal with it?** 10:39AM

A I do not know.

**Q Okay. If someone were to say they didn't know whether or not poultry waste contained pathogens, I know you have said it's pretty well known in your papers, what would -- what reasonable inquiry would it take for someone to educate themselves to understand pathogens are contained within poultry waste?** 10:39AM

MR. McDANIEL: Object to the form.

MR. GEORGE: Object to the form. 10:39AM

A I would imagine that what you could do is take a microbiologist and have them plate, take a sample and plate the litter.

**Q But as general knowledge, we have the useful benefit tool of the Internet today; would you agree?** 10:40AM



A Uh-huh.

**Q And from that, a lot of source of information is available; would you agree?**

A Could be, yes.

**Q And in many respects papers published from the University of Arkansas are available on the Internet, are they not?** 10:40AM

A True.

**Q Have you seen published papers speaking about pathogens being within poultry waste?** 10:40AM

A Surely I have, but I can't recall them specifically.

**Q Okay. Let me ask it this way: Are you aware of any studies that would contradict the thinking that poultry waste contains pathogens?** 10:40AM

MR. McDANIEL: Object to the form.

A No.

(Whereupon, a discussion was held off the Record.)

**Q Bear with me a second. I want to find a quote here that I want to speak to you about.** 10:41AM

A I'll get my heart beat down a little bit.

**Q Okay. At Page 325, sir, at the upper right-hand corner, there is a statement that says, however, fecal coliform counts prior to the rise in** 10:42AM



**poultry in this state are not available. What I'd like to ask you about is the statement prior to the rise in poultry. What time frame are you speaking to when you wrote this in 1995, if you know?**

A I apologize. I don't know what we meant there. 10:42AM

**Q When you say rise in poultry, are you talking about the number of birds, that they've increased?**

A I would assume we're talking about the evolution of the industry in northwest Arkansas, Georgia and so forth. 10:43AM

**Q And its rise or growth?**

A Yes, sir.

**Q All right. Let me hand you now what's marked as Exhibit No. 5. This again is -- I apologize for the quality of this document but we're not going to have to read all of it. This again is another one that you co-authored with Dwayne Edwards, is it not?** 10:43AM

A Yes, sir.

**Q And I'll note at the bottom this was published in the environmental quality -- Journal of Environmental Quality in 1993. At the upper right-hand corner, the second column, there's a sentence. The first full sentence starts, the possible consequences of the entry of organic** 10:43AM 10:44AM

**fertilizer constituents into streams and lakes are well known. Do you see that?**
A Yes.
**Q And you are writing this in 1993. Explain to me how that is, how is it well known; what do you mean?** 10:44AM
A I think we're referring there to animal waste in general, swine waste, dairy manure. When Dwayne and I came in '89, there were no published articles on land application of litter and the impact on water quality, probably one of the reasons we got funded on some projects, but we did know if you put out X amount of dairy manure or swine manure and that you would have those -- you could have detrimental effects. 10:45AM
**Q Further down in this same column, that last paragraph says, runoff concentration of poultry manure have been demonstrated to be extremely sensitive to the interval between application and first runoff event. Is that still true today?** 10:45AM
A Yes.
**Q And then I'm going to skip back up and it says, research performed over the last two or three decades has been oriented toward development of technologies, with the objective of minimizing** 10:45AM



**downstream impacts of animal waste application by minimizing masses of animal waste constituents transported off the area of application or edge of field losses. Were you speaking then at this time -- are you dealing with all animal waste or is this limited to dairies, swine, poultry; do you know?** 10:45AM
A Let me read it again. I think we're talking about in general, manure in general.
**Q And as of late, however, edge of field losses is something that you have continued to look at and study regarding the poultry industry; correct?** 10:46AM
A Or any -- yes.
**Q And would this statement be applicable today with regard to the poultry waste and edge of field?** 10:46AM
A Yes.
**Q You talk about possible consequences of entry of these organic fertilizer constituents and when we -- just for the court, when we're talking organic fertilizer, we are talking about poultry waste or animal waste; correct?** 10:46AM
A Or sludge or human waste, yes.
**Q Thank you, and as contrasted with inorganic waste, which would be commercial fertilizer; is that a correct statement?** 10:47AM



A Correct.
**Q Okay. Then when they talk about the possible consequences of this organic fertilizer, you list several of these, lower dissolved oxygen. Do you know what that causes or effect -- I'll restate that. It's not very good. What may be a causal effect of lower dissolved oxygen in water?** 10:47AM
A Fish kills.
**Q It's correct -- tell me if I'm correct in saying that excessive inputs of nitrogen and phosphorus to water bodies have been extensively linked to accelerated eutrophication, which can in turn give rise to a host of undesirable consequences. Is that a fair statement?** 10:47AM
A Yes.
**Q Let's talk about what those consequences are. Undesirable consequences from excessive inputs of nitrogen and phosphorus into water bodies. What do we see occur?**
A Well, I think you said excessive. 10:48AM
**Q Yes, sir.**
A Well, it's basically -- I think primarily most of the scientists are saying now that it's most of our water bodies are phosphorus limiting and what we will see is growth of aquatic weeds and algae to 10:48AM



varying extents of degree that it's over fertilized.
**Q Do you know or have an opinion what constitutes excessive?**
A That is the $64,000 question.
**Q We do know that introduction of nitrogen and phosphorus to a water body can contribute to the algae growth that you just described; correct?** 10:48AM
A Yes.
**Q When you began your studies at the University of Arkansas, and we've seen several papers here already today this morning, what, if any, efforts did the University take to inform the poultry industry of effects of land applying poultry litter?** 10:49AM
MR. McDANIEL: Object to the form.
A Well, when Dwayne and I received funding, we began to design projects, and one of the things we wanted to do just so that we didn't make any mistakes, and it was obvious that we did something wrong, just something very impractical, we tried to involve all those stakeholders to some degree in designing the experiment and -- 10:49AM
**Q When you say stakeholder, are you talking about then the poultry industry?**
A Uh-huh, growers and extension poultry specialists, the integrators, just all the people 10:50AM

that would be affected.
**Q And even landowners who may just be cattle growers or cattle raisers?**
A Yes.
**Q And in your experience over the years is there anyone in the poultry industry that you seem to have kind of an open door policy with or the ability to communicate with directly?** 10:50AM
A Like -- well, we used to have a good liaison with Claude Rutherford, and I think he was probably the gentleman officially or unofficially that was sort of the spokesperson, and we worked a lot with him. He would give lectures in my class. 10:50AM
**Q Does he have any background in soils or water quality, if you know?** 10:51AM
A Not that I know of.
**Q So his background would be in the producing of the poultry and growing birds; correct?**
A Yes. I think he worked for Simmons.
**Q Okay.**
A He was a landowner, grower in I think Prairie Grove.
**Q I'm going to apologize but I'm going to take you back to Exhibit 4 for a second and look at a quote there that says --** 10:51AM



A I got it.
**Q -- at Page 326, the very lower left-hand corner, in the last paragraph, second sentence there, the most effective BMP, which is best management practice, is limiting land application rates to those needed for nutrient utilization. That kind of falls in line with the $64,000 question you mentioned earlier, isn't it?** 10:51AM
A Well, let me back up. I don't think -- you know, whenever this was written, we didn't even know -- a lot of science has gone on. The most effective BMP, if you are talking about phosphorus, is getting the phosphorus out of the feed. I mean that's the silver bullet. 10:52AM
**Q Knowing that it's in the feed, though, the next best effective BMP would be limiting land application of that phosphorus, would it not?** 10:52AM
A Limiting -- well, I would put it this way: Making sure that the application rate is consistent with production practices and you're doing -- you know, it's a holistic system. You're -- you know, you are trying to put in buffers. You are looking at it from a holistic standpoint. 10:52AM
**Q And as part of that holistic standpoint, this may be over simplified but it's pretty straightforward, if you have a good soil test and that soil test tells you that the needs of that particular crop of grass, Bermuda or fescue, is 30 pounds of phosphorus, applying more than 30 pounds of phosphorus would not be correct, would it?** 10:53AM



MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
A I think here's where the -- where the river hits the road. Historically that is not the way it's been managed. 10:53AM
**Q You mean -- what do you mean by that?**
A Well, the soil fertility people will do studies and they will come up -- I think they've come up with something, we have recently, and say 50 parts per million is the upper limit where you don't get a response to forages, and now that to some degree has changed a little bit, and that -- it never has been a drop dead number, but as the process continued to increase in terms of the industry, land application, the issue came up as surface as regard to cut-off levels, thresholds, upper limits. 10:53AM 10:54AM
**Q And I'm going to talk to you about that in a little bit because we know about the NRCS that has one or makes a recommendation, correct; are you aware of the NRCS making a recommendation of an upper limit?** 10:54AM
A No.
**Q Okay. Well, I'll have some more questions later and we'll talk about that.** 10:54AM
A That's all right.
**Q For the court, 50 parts per million, can you easily equate that to pounds per acre or not?**
A I can but it's probably not right. We have -- this is something -- the reason that our division has gone to parts per million is that we get in these situations and we have to convert that into pounds per acre. You can do that, but there's a lot of assumptions, and that's basically why we've gone to parts per million, so we know that that's what it is. It's a four-inch sample. That's what the concentration is, and if you have a cut-off level, you don't have to do these conversions. 10:55AM
**Q Okay. If you were to convert this, can you give me a ballpark about what that is, 50 parts per million?** 10:55AM
A Yes. If it's a zero to four-inch sample, that would be times 1.33. 65 or -- something.
**Q You've told me what you would use. That's what I need to know.** 10:55AM

A Yeah.
**Q All right.**
A And what we're -- just to stop this craziness, we're trying to get other people to do the same thing.
**Q Parts per million?**
A Parts per million.
**Q Standardize it?**
A Standardize it.
**Q Do you see that happening anywhere else in the country?**
A I think it will, yes, because the -- I mean the pounds per acre is just a term that's probably done more for the grower and the farmer than it is for scientists, but that's really what we ought to be working with is parts per million.
**Q And I understand that, and that's the University of Arkansas' position. Do you know if anyone else in the country is like you espousing that position?**
A I'm sorry, I don't know. We should; I should know that.
**Q Back to this statement that most effective BMP is limiting land application rates to those needed for nutrient utilization, that's not occurring in**



**the Illinois River watershed, is it?**
MR. GEORGE: Object to the form.
A No.
**Q And over the past as you've described, it hasn't been occurring over the past either historically?**
A If you're asking me has there been a threshold or cut-off level of 50 parts per million, no.
**Q Well, what I was really asking is that historically there's not been a limiting of land application in the IRW as a best management practice?**
A Limiting land application? I think in northwest Arkansas, in the Illinois River, it is determined by the index, phosphorus index.
**Q As of today. I'm talking about historically, it wasn't in the past, though?**
A No.
**Q Let's see if I can find -- while we're sort of in that subject, I'm going to skip a little bit ahead and let you look at Exhibit 12, if you would, and specifically I want to talk to you -- continue our discussion with regard to a statement made in the last paragraph of this exhibit, midway down where it says generally -- I'm sorry. This is an**



**article described as the phosphorus index background and status of which you are listed as the primary author; would you agree?**
A Right, uh-huh.
**Q This was published. Do you know when the date of this publication occurred?**
A I'd say early '90's. It was part of the symposium I think.
**Q And what that -- the symposium, is that the one that was conducted at Springdale with the National Waste Symposium or was it a different symposium?**
A Different symposium.
**Q Different?**
A Yes, sir.
**Q And you believe it's the early '90's?**
A I'm guessing it is.
**Q Kind of off to the side -- how come these things don't get dated very often?**
A This is probably now, you know, in the other pubs, JQ's, all the ones that are dated. This is a paper that -- I think they call it a white paper, whatever the hell a white paper is.
**Q Right.**
A And I think this is part of that Huminick



Consortium that identified certain things that needed to be done. One of them was a review of the index.
**Q Okay. You've brought up something I'm not familiar with, Huminick?**
A Frank Huminick was a gentleman that was in charge of the Animal Waste Center I think in North Carolina. It was supposed to be a clearinghouse for animal waste issues, these sort of things, and they got federal funding and had meetings, and we identified things that needed to be done, needed to be written on, and this is one of them.
**Q I appreciate you telling me. Thank you. In referencing this one at the lower portion of the document, generally environmental threshold P values are three to four times the level of soil P that would not limit crop production, and it cites Sharpley at 1996. Explain to the court what you -- what that means generally in lay terms.**
A Okay. Let's take that 50 parts per million and let's say that that is the upper limit in terms of to grow forage. Now, what that is saying is that -- say a rule of thumb people have tried to say, okay, let's multiply that 50 by three or four. Let's take four, so that would be 200. So that

would be an upper limit.
**Q And that's the threshold you are talking about?**
A Yeah, but legally I think there's only one state that's got one. 11:01AM
**Q And is that Arkansas or Oklahoma?**
A Texas.
**Q Okay.**
A I mean written into the state law.
**Q Okay. Then you said earlier -- that's why I'm going to follow up because you're not familiar with the 300 pounds per acre threshold maximum that NRCS publishes as part of the waste management plan or nutrient management plan? 11:01AM**
MR. GEORGE: Object to the form. 11:01AM
A I'm sorry, I don't think they've ever said that to my knowledge, and they may have a recommended, and I doubt whether they would even do that. They are a pretty neutral agency on those kinds of things. 11:01AM
**Q Okay.**
A And if that is the case, I'd like to know it just -- I think that -- 300 pounds per acre is a number that's been batted around ever since we got into this issue, and we talked about it in northwest 11:02AM



Arkansas, but to my knowledge EPA, NRCS, there are no legal requirements for a threshold.
**Q 300 pounds per acre would be three or four times, though, the agronomic need of Bermuda grass or fescue grass, would it not, for phosphorus? 11:02AM**
A Yes, generally, yes. Now, I'm going to clarify something here. Our fertility specialist -- I just want to go on the Record so you'll know this. Our fertility specialist, Nathan Slaton, has been doing work on phosphorus on Bermuda and fescue 11:03AM grass, and this is not published, but he has received response to fertilizer in terms of yield above the 50 parts per million level.
**Q And that's been recently?**
A Yes, sir. 11:03AM
**Q And do you know what that limit is above -- obviously greater than the 50, but do you know what the number is?**
A It's quite high, and I didn't have a chance to talk to him. I knew this was going to come up, but 11:03AM it -- you know, the reasons behind this is that when -- this is Bermuda grass and when you are pushing the system on yield and you are trying to get maximum yield, the system is such that the plant biomass is growing so fast and is taking the 11:03AM



phosphorus up, and the dissolution and equilibrium of the stored phosphorus is not able to keep up, so it does respond to a little bit of -- but I would suggest that for further details on that, chat with him. 11:04AM
**Q And you say that was Bermuda or fescue?**
A I believe it was in Bermuda grass, and that's a rare finding. It's rather interesting.
**Q It is because there's no one else to my knowledge in what I've read -- 11:04AM**
A It's not a whopping amount but the last cutting was -- did show up.
**Q And he's doing that work at the University of Arkansas?**
A Yes, sir. 11:04AM
**Q Is it in the experimental area of Savoy or elsewhere?**
A I think -- I don't know, so I won't comment. I think it's probably on some of our farms that has high soil test P. He does it on university property 11:04AM as well as on grower fields.
**Q Let me now hand you Exhibit No. 6, Dr. Daniel, and this is another article, which you co-authored with Sharpley and Simms and Pote, and I believe this shows a Journal of Soil and Water Conservation 11:06AM**



**published on a date of March/April 1996. In this document at the first column, most of the way down there's a sentence that starts, the loss of phosphorus in agricultural runoff is of increasing concern in several areas of the United States, 11:06AM primarily where the production of phosphorus in manure from confined animal operations exceeds local crop requirements of phosphorus. Is one of those areas the area of the Illinois River watershed in your opinion? 11:06AM**
A Well, I think we're talking about any area where you have confined animal feeding operations in a high density like the Bosque River, certainly in northwest Arkansas, Georgia, Alabama, Delmarva Peninsula. 11:06AM
**Q I've been handed a queue card. We're going to take another one of those breaks for film.**
VIDEOGRAPHER: We're now off the Record. The time is now 11:07 a.m.
(Following a short recess at 11:06 11:07AM a.m., proceedings continued on the Record at 11:17 a.m.)
VIDEOGRAPHER: We are back on the Record. The time is 11:17 a.m.
**Q Dr. Daniel, I've handed you Exhibit 7, which 11:17AM**

**is another article that shows you as the primary author with Dr. Sharply. He is a doctor, a PhD?**
A Yes, sir.
**Q Yeah, and Lemunyon?**
A Lemunyon. 11:17AM
**Q Okay. This was published in the Journal of Environmental Quality again in 1998 as a symposium paper. Do you remember where this was presented?**
A Yes, sir. It was presented at the Indianapolis meeting of the Soil Scientists of 11:17AM America in '96 I believe.
**Q You're a member of that organization?**
A Yes, sir.
**Q Have been for how long?**
A Probably '72. 11:17AM
**Q All right. Are there any other professional organizations that you're a member of besides that one?**
A Off and on Soil and Water Conservation Society, off and on ASAE, American Society of Ag 11:18AM Engineers.
**Q Do you subscribe to their publications?**
A Yes, sir.
**Q In this particular document, Exhibit 7, the first -- actually the second paragraph where it says 11:18AM**



**runoff from agricultural land is one of the major sources for non-point source pollution, is that again your opinion today?**
A Yes.
**Q In reports to Congress the USEPA has 11:18AM identified agricultural non-point source pollution as the major source of stream and lake contamination that prevents attainment of water quality goals identified in The Clean Water Act, and it cites USEPA and Parry. Is that still a true statement 11:18AM today?**
A Probably less true. Now, just make sure you understand that when we presented this earlier in our career, we could almost get in a fist fight with people that took offense at pointing the finger at 11:19AM agriculture, but agriculture is the major land use in the United States. In terms of unit loading, you know, pounds per acre per year, that sort of thing, it's quite lower than, say, an urban setting, so taken as an aggregate, obviously it would be the 11:19AM largest.
**Q In an urban setting a lot of that waste is, of course, run through treatment plants and that sort of thing also, too?**
A I didn't mean to interrupt you. 11:19AM



**Q When we see an urban setting, we do see wastewater being treated in plants generally in urban settings?**
MR. McDANIEL: Object to the form.
A Yes, sir, but there are also 11:19AM stormwater drains, stormwater. There's separate sources. One is going directly to your sanitary sewer and one is a stormwater, and the stormwater from urban environments is very high in unit loading of phosphorus. 11:20AM
**Q Okay. In the same paragraph it says that the input of P in agricultural runoff can accelerate the eutrophication of P-sensitive surface waters. We've talked a little bit about that. Eutrophication is -- for purpose of the court, define your 11:20AM understanding of eutrophication.**
A Eutrophication is a natural process of fertilization of a water body. It's a natural process, and it's going to -- over time it's going to become more eutrophic, and what we are -- what 11:20AM we're doing in terms of human activity is accelerating that natural process.
**Q This goes on to say, in an increasing number of areas, the potential for P loss or phosphorus loss in runoff has been increased by the continual 11:21AM**



**land application of fertilizer and/or manure from intensive livestock operation. That's still true today in your opinion?**
A I think probably more true then because at that time land application of manure was still based 11:21AM on nitrogen, on the nitrogen rate that was required to meet the crop, and this symposium and others changed that. Now, now, it's -- nationally it's at least phosphorus based.
**Q And that's assuming that in applying it for 11:21AM the phosphorus, one would follow the recommendations of the needs of the agronomic needs of the crop?**
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
A That's not -- I mean that's not -- I don't 11:22AM think that's true in every case. Generally and nationally it's determined by the phosphorus index.
**Q And if someone has a soil test that tells them how much phosphorus their particular pasture needs and they put on twice as much than that which is 11:22AM called for in the soil test, that's going to contribute or accelerate eutrophication as that gets to the water bodies; correct?**
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form. 11:22AM

A I think that would be too broad a statement for me to agree to.
**Q Okay. Let me break it down. If a soil test calls for 30 pounds per acre of phosphorus and one puts on 60 to 100 pounds per acre, you would agree that that increases the potential for runoff?** 11:22AM
MR. McDANIEL: Object to the form.
A Yes, and that is the reason why the phosphorus index was developed. The phosphorus index was developed to manage the phosphorus risk of runoff. 11:23AM It's not -- I mean it's not always -- it doesn't always take in consideration the soil test P level that is the -- that is the 50 parts per million.
**Q And I understand how the index works, that there are other factors that are looked at with regard to the type of soil, slope of the soil, the time of application, those sort of things; correct?** 11:23AM
A Yes, sir.
**Q Would you agree it's true that as soil phosphorus content increases, the potential for particulate and dissolved phosphorus transport in runoff increases?** 11:23AM
A Is that in here?
**Q Yeah. We can look at Page 253, the very top right-hand corner. As soil P content increases, the** 11:24AM



**potential for particulate and dissolved P transport in runoff increases. Is that still true today?**
A Yes.
**Q And that's true in the Illinois River watershed?** 11:24AM
A True.
**Q Page 252 of this paper, it talks about accelerated eutrophication and problems for fisheries and recreation, industry and drinking. I think we talked a little bit about some of that but let's expand on that because we have talked about fish kills.** 11:25AM
A Yes, sir.
**Q We know that can result. You also say here that recreation can be a problem as a result of -- let me just read it. Advanced or accelerated eutrophication of surface water leads to problems with its use for fisheries, recreation, industry to problems with use -- I'm sorry. I missed a line. Let's just start on the line recreation. How are those problems as a result of eutrophication exhibited?** 11:25AM
A Well, if there is, you know, a fairly large algae bloom, you may be -- impair your scuba diving, boating if you have aquatic weeds. 11:25AM



**Q And drinking, how is accelerated eutrophication a problem with drinking?**
A Well, it can result in -- at high levels of -- treatment cost goes up, taste, potential taste or odor problems. 11:26AM
**Q Accelerated eutrophication can result in surface blooms of cyanobacteria causing fish kills, unpalatable -- unpalatability of drinking water and formation of trihalomethane during chlorination. Is that true?** 11:26AM
A Yes.
**Q And it's true today?**
A Uh-huh.
**Q And that -- and is it true within the IRW?**
A Yes. 11:26AM
**Q Let's talk a little bit about cyanobacteria. Is that also something that's commonly referred to as blue-green algae?**
A I hope it is. Yes. I'm not an algae specialist either. Sorry. 11:26AM
**Q Do you know whether or not cyanobacteria or blue-green algae can be harmful to animals or humans?**
A I'm not sure about the cyanobacteria but I know there are some major harmful algae blooms that 11:27AM



are -- that can impact human beings as well as animals.
**Q Are those harmful blooms something that an untrained eye would know exists in, say, pond water or a stream?** 11:27AM
A No. I mean they're rare but they do exist, and they're increasing.
**Q And when they do exist, you can't tell -- it doesn't have a signal to it that says I'm harmful?**
A Not that I know of, no. 11:27AM
**Q Much like poison ivy, if you've got three leaves, you know you've got a potential of some harm; correct?**
MR. GEORGE: Object to the form.
A Yes, but, again, you're skating on thin ice with my expertise here, and I'll do the best I can. 11:27AM
**Q We'll skate past it then.**
A Okay. Well --
**Q In your studies with regard to this area, are you aware of any reports of the existence of cyanobacteria in the Illinois River watershed?** 11:28AM
A No.
**Q Are you familiar with trihalomethane in your studies?**
A I know of it and from other researchers, yes. 11:28AM

**Q All right. Do you know whether or not it's a carcinogenic?**
A Again, it's my understanding that at certain levels it is a carcinogenic.
**Q Moving to Page 256 in the conclusions portion of this, the first part of that conclusion it says generally the loss of agricultural phosphorus in runoff is not of economic importance to a farmer. Tell me what you mean.** 11:28AM
A In general when you land apply manure, and historically when we've taught classes in Soils 101, we said phosphorus didn't move in the environment, did not move, but to answer your question, if we put out X amount of phosphorus and we get a rain on it, we may lose 2 to 3 percent of that phosphorus that leaves that area. That's not much to a grower, I mean, but to the environment it may be a lot. I think that's basically what we're saying. 11:29AM
**Q All right. It goes on to say at that same place in the article, however, it can lead to significant off-site economic impacts, in some cases occurring many miles from the phosphorus source. Is that still true in your opinion today?** 11:30AM
A Uh-huh, yes.
**Q And when you say that, are you -- well, let me** 11:30AM



**let you tell me what you mean by that rather than me trying to restate it.**
A Well, I mean I think what we're saying is if you are having major sources of -- well, just like phosphorus that's entering the Illinois River from a wastewater treatment plant, the potential for algae blooms and all those bad things we talked about before go up. 11:30AM
**Q And, likewise, that same potential could arise from runoff from pasture land that's been fertilized with poultry waste?** 11:31AM
A Yes, over fertilized, yes.
**Q By the time -- this goes on to say, by the time these impacts are manifest, remedial strategies are often difficult and expensive to implement. They cross political and regional boundaries, and it can be several years or decades before an improvement in water quality occurs. In your opinion do we see that existing in the IRW today?** 11:31AM
MR. McDANIEL: Object to the form. 11:31AM
A I'm going to defer -- I don't know because I'm not a -- more of an in-stream biologist.
**Q Okay. It's out of your area and you feel uncomfortable making an opinion on that; is that a fair statement?** 11:31AM



A That's a fair statement. I will say that the colleagues that I talk to will say that they are -- there's no obvious trauma to the patient but there's indications of maybe increased blood pressure, that sort of thing. 11:32AM
**Q Who are the colleagues you are referring to?**
A Be Dr. Brian Haggard, Dr. Matlock.
**Q I'm sorry, the last name?**
A Dr. Marty Matlock.
**Q Any others?** 11:32AM
A That's generally who we deal with.
**Q Okay. Let's now look at Exhibit No. 8. I apologize for the quality of this. It came from a source that's rather old and I think it's been copied several times, but this is an article co-authored by you and Mr. Moore and M. L. Self-Davis it looks like and Dwayne Edwards again.** 11:32AM
A Yes.
**Q Do you recall doing this piece of work and ultimately authoring or co-authoring this?** 11:33AM
A I don't but --
**Q What --**
A That's okay.
**Q What I was trying to do is figure out when this was done or what time again this was published.** 11:33AM



**I don't see anything on this document that indicates a publication date.**
A I'm guessing this is a proceedings at some conference.
**Q Okay. I have noted that there's a reference to a Moore paper in one of your papers as 1997. So it had to be certainly after '97 or sometime after '97; would you agree?** 11:33AM
A Yeah. I don't know. I'm sorry.
**Q The very first paragraph, let's just look at it and see if this is still your opinion today. In areas where dense production of poultry occurs, the litter is most often surface applied to pastures in the area of production facilities. That was your opinion in '93. Is that generally what we're still seeing today?** 11:33AM
A Yes.
**Q Consequent problems that have been associated with this practice are elevated P levels in the soil and excessive P concentrations in runoff from pasture land, and I think you said that's still true today?** 11:34AM
A Yes, it can be, yes, uh-huh, a concern, uh-huh.
**Q Do you see that occurring in the IRW, if you** 11:35AM

**know?**
A I haven't -- well, I guess I have. I have seen land applications, so I assume it's occurring, yes.
**Q It also then goes on to say, it is well documented that increased P levels in runoff can adversely impact surface waters by accelerating the eutrophication process. We've spoken of that earlier. That still occurs today?** 11:35AM
A Sure, yes. 11:35AM
**Q All right. Let's go back and look at the acknowledgments on the next to the last page I believe of this document. This is an example of where the U. S. Poultry & Egg Association provided some funding, isn't it?** 11:35AM
A Yes. I'm not familiar with the details on this one but, yes, as well as Dwayne Hudson funding from U. S. Poultry.
**Q Do you know if when that occurs, such as U. S. Poultry & Egg provides funding, do they then take your papers and disseminate it among their association members?** 11:36AM
A Yes.
**Q Are you aware of any documents, papers or studies out there that would contradict the** 11:36AM



**statements made in this paper, in particular the first paragraph?**
MR. McDANIEL: Object to the form.
A In general, no.
**Q I'll now hand you Exhibit No. 9. This is one of those documents that is undated, but this shows University of Arkansas Division of Agriculture and Cooperative Extension Service at the top. It shows where you, Mike Daniels, Tommy Daniel, that's you; correct?** 11:36AM 11:37AM
A Correct.
**Q And Carl VanDevender?**
A Yes, sir.
**Q Participated in preparing this material; is that true?** 11:37AM
A Yes.
**Q Do you know when this was published?**
A Mid '90's I'm guessing. Got to be somewhere in there.
**Q Is there someone else that might know?** 11:37AM
A We can call Mike and find out.
**Q Mike Daniels?**
A Yes, sir.
**Q He's still there at the university?**
A Yes, sir. 11:37AM



**Q Okay. This talks about plants deriving phosphorus needs from soil, and it goes on to say in the second paragraph, inorganic phosphorus sources are added to poultry and swine feeds to ensure adequate nutrition and to prevent rickets. Is that information you gathered while talking to the industry representative personnel?** 11:38AM
A Not only the industry reps but also like the poultry extension specialists.
**Q So when you are talking about this inorganic P source, this then is something in addition to that which obviously comes in with the grain that has the organic form of P?** 11:38AM
A Yes. It's added because of the -- the organic P is not available and so calcium phosphate is added. 11:38AM
**Q All right, and that's in part because we talked about earlier that the organic P has a tendency to pass through --**
A Yes. 11:39AM
**Q -- the intestines or the gut of the animal?**
A Correct.
**Q Okay. You talked about the inorganic P being excreted. How much of the organic P is excreted, if you know, in comparison to the amount input to a** 11:39AM



**bird?**
A I really don't know. I'm not familiar with that.
**Q Okay. This I believe speaks at some point about mineralization as it relates to phosphorus. Do you know what mineralization means as it relates to phosphorus?** 11:39AM
A I would assume that it's referring to the decomposition of the material that's composed the litter, the fecal material as well as bedding. 11:40AM
**Q And that is occurring outside the bird after it's excreted it?**
A Yes, sir.
**Q Do each form of phosphorus, that is inorganic and organic, contribute to the nutrients known to cause algae blooms in streams and lakes?** 11:40AM
A Yes. The inorganic would be the most rapid. The organic would require decomposition.
**Q That's the slow release we talked about?**
A Yes, sir. 11:40AM
**Q So it's clear, poultry manure, in addition to phosphorus, contains nitrogen and potassium, does it not?**
A Correct.
**Q When we're using the term phosphorus as we've** 11:40AM

**been generally speaking to it, is it really a phosphate that we're talking about that occurs here that's excreted as opposed to elemental phosphorus?**
A Yes, it's a P04.
**Q But it's common just to use the term phosphorus --** 11:41AM
A Right.
**Q -- as I see in your articles; true?**
A Yes. We kind of refer to it as a generic term, phosphate, phosphorus. 11:41AM
**Q I believe this article speaks to the average nutrient values for manure samples collected from broiler litter in pounds per ton, if I'm not mistaken, at Table 1. Is this material that you developed in order to publish this paper or the three of you?** 11:41AM
A Okay. These values derive from manure samples collected by producers -- sounds like this was done by the division soil testing program.
**Q And you just reported what they determined or found?** 11:42AM
A Yes, sir.
**Q Okay. How do the levels that we see in broiler litter of nitrogen, phosphorus shown here equate to the needs of a typical Bermuda or fescue** 11:42AM

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**crop?**
A Well, they're obviously -- looking at that from broiler litter, on a P205 basis you're almost on a one-to-one basis of P205 to N. So when you're meeting -- that's been the problem. When you are 11:42AM meeting the nitrogen needs of the crop by applying manure, you are over applying on the phosphorus.
**Q All right, and so the nitrogen needs of the crop would be what in relation to the value shown in the manure of 56 in this example?** 11:43AM
A Depends on the crop, of course, and on the yield.
**Q Pasture land and grass, three to five acres; I mean is there kind of a standard that you look to?**
A Just roughly I think on like a fescue would be 11:43AM three tons per acre.
**Q And so what would be the needs of the nitrogen that we see compared to the actual value of the nitrogen in manure?**
A I think that for forage for nitrogen would be 11:43AM somewhere I think around 100 to 150 pounds of N required.
**Q Okay.**
A Again, I'm kind of skating on thin ice here.
**Q I'm going to leave it, too.** 11:43AM

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A Okay, good. Thank you.
**Q These aren't numbered pages. So we're looking at the third page where it shows Figure 1 in the paragraph above it. It states, for land with high STP levels. Tell the court what is STP levels.** 11:44AM
A STP is an acronym for soil test phosphorus, and that is generally if you get a soil sample from your lawn and send it in, it will come back with a level of phosphorus, and it's a soil test phosphorus level. 11:44AM
**Q Typically we see those levels being reported in the pounds per acre?**
A Yes.
**Q As opposed to what you would prefer in the milliliters; correct?** 11:44AM
A Right, or parts per million.
**Q Parts per million?**
A Uh-huh.
**Q So this goes on to say, for land with high STP levels, it is now known that appreciable amounts of soluble P can exist in the runoff water from these areas and can significantly impact water quality in nearby streams and lakes. As a general statement, is that still true?** 11:45AM
A Yes. Significant is an adjective, but it 11:45AM

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definitely can impact, yes.
**Q And is that similarly true in the IRW?**
A Yes.
**Q This gets -- the second column below the heading how much soil test phosphorus is needed?** 11:45AM
A Uh-huh.
**Q The first sentence of this says, Arkansas scientists agree that there is no agronomic reason or need for STP levels to be greater than about 80 to 100 pounds, and that refers to phosphorus by the** 11:45AM **Mehlich III extraction, per acre. First off, let's break that down. Explain to the court what the Mehlich III extraction is. I don't mean its technical term, but generally what it means.**
A In most soil -- in all soil test programs what 11:46AM you try to do is take an analysis of that soil and exert it to or have it undergo some chemical tests so that you can estimate the plant available phosphorus that's in there, and every state has a different recipe. 11:46AM
**Q And that particular Mehlich III extraction method is used in the state of Arkansas, is it not?**
A Correct.
**Q And it's to your knowledge used in the state of Oklahoma?** 11:46AM

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A I think it is, yes.
**Q All right.**
A Just for the Record it is one that's becoming more accepted throughout the southwest -- southeast.
**Q Okay. So when we talk about Arkansas scientists agree, would you be one of those people that agree to this statement; is that who we are talking about?** 11:46AM
A That -- yes, uh-huh.
**Q And the 80 to 100 pounds per acre of phosphorus, if we go back to your preferred method of parts per million, it would be approximately the 50 parts per million?** 11:47AM
A Something like that, yes, sir.
**Q Okay. The Figure 1 that we're looking at I believe shows, does it not, that the concentration of phosphorus in runoff increases as soil test phosphorus increases?** 11:47AM
A Yes.
**Q Is that an accepted statement today?** 11:48AM
A Yes. Now, let me clarify also, this is done under rainfall simulation conditions, a very small area. When you get -- when you scale up -- a lot of the stuff that you'll probably be quoting is done through rainfall simulation studies. They've never 11:48AM



been done to represent the real world. They are done to compare relative comparisons. Like what we did here was compare soils with very low soil test P and high soil test P, and we can do that with a rainfall simulator, and the numbers that we have are 11:48AM exaggeratedly high probably in the runoff but the concept applies to watersheds.
**Q And that's the whole point, that the concept does exist?**
A Yes. 11:48AM
**Q And when we have a high soil test phosphorus in a watershed, it would certainly raise a red flag to the potential of risk to the environmental water bodies?**
MR. McDANIEL: Object to the form. 11:49AM
MR. GEORGE: Object to form.
A Yes. Now, unfortunately or fortunately depending on what you're -- this is one soil and every soil has a different release characteristic.
**Q And many soils are identified with regard to that release characteristic as being either a high risk or low risk, are they not; I mean we have a -- soils are characterized showing high or low risk with regard to runoff or leaching, are they not?** 11:49AM
A They are in the soil survey manual book, and 11:49AM



their response to phosphorus is not.
**Q All right. So that rating or characteristic as we've just talked about is related to what, if not phosphorus?**
A It would be related to the absorption characteristics of the soil and the release characteristics. 11:49AM
**Q And that absorption and release deals with water only or other constituents?**
A With water, with runoff water, and again just to make myself sure, you've got a Captina silt loam here, and we've done that with various other soils, and the slope of the line may be flat as a pancake on something, some. 11:50AM
**Q The Captina soil is soil that you find in the Illinois River watershed?** 11:50AM
A Yes.
**Q Do you have any estimate of the amount of that kind of soil on a percentage basis that we see in the watershed, Illinois River watershed?** 11:50AM
A Ones with high soil test P?
**Q Yes, sir. Well, just the type of soil, Captina?**
A No, I don't, no.
**Q Do you know of any studies or sources that would show us the percentage of kinds of soil that are maybe by county level or watershed level?** 11:50AM
A I'm sure there's some out there but I'm not aware of them.
**Q All right.** 11:51AM
A It should be inventoried. The NRCS could inventory that.
**Q At the lower right-hand corner of this same page we see the statement I think we've talked about but I'll read it again, high levels of phosphorus can require as many as 15 to 20 years of continuous crop harvesting for removal with no additional P from any source during that time. That's part of the slow release portion that we've talked about; is that correct?** 11:51AM 11:51AM
A Or draw down. You got to be harvesting it.
**Q Otherwise, it sits there for as much as 15 or 20 years?**
A Well, it does and doesn't. It sits there, but it will -- it will over time if you don't even -- if you've just got pasture and you're not exporting, it will over time take that phosphorus that's more available and make it into a less available mineral form, but it's a long time. 11:51AM
**Q At least 15 or 20 years based on your** 11:52AM

**estimations here?**
A It's a long time, yes. Dr. Sharply has done some and published some work on that.
**Q Now, the next page at the top, this gets back to I think some of the discussions we've had, but let me read it. Origin maximum STP level has not been set by soil scientists or the National Resource Conservation Service. When you are using the NRCS there, you are referring to the federal one?** 11:52AM
A Yes, sir. 11:52AM
**Q However, one suggested limit that has been debated is 300 pounds per acre by the Mehlich III extraction testing method. You and I were discussing this earlier even off the Record. What is the source of that 300-pound recommendation that's being debated, and your opinion is you don't know?** 11:52AM
A Now, that number has been debated within the state for -- almost ever since I've been here and other states. It's just a number that's been thrown out there. 11:53AM
**Q And we know that number exceeds plant needs of pasture land, such as Bermuda or fescue; correct?**
A Yes.
**Q Why would you debate something that so far** 11:53AM

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**exceeds the need of the crop when we know the impact leads to water quality problems?**
MR. McDANIEL: Object to the form.
A I guess there are scientists that have been trying to find that level. We know that -- let's say at 50 parts per million -- that's a good question, by the way, not one that hasn't been asked before. We know that 50 parts per million probably doesn't result in any increased growth of fescue in general. We also know that there is some level out here that in terms of soil test P that is probably not recommended in terms of a resource. 11:53AM 11:54AM
**Q 300 probably would be a level that shouldn't be recommended; would you agree?**
MR. McDANIEL: Object to the form. 11:54AM
MR. TUCKER: In fact, let him go ahead and finish the answer. I think you already asked him the next question before he finished the answer.
**Q I'm sorry. Were you not finished?**
A No. That's all right. 11:54AM
**Q I apologize.**
A I'll let it go this time, sir.
**Q All right, and I'll try not to do it again. I apologize.**
A I think our body of scientists have been 11:54AM

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trying to -- since the early '70's have been trying to come to grips with the question you asked and, that is, where is that level between not responsive to the plant in terms of phosphorus and when it becomes a harm to the resource, and as of to date, even our national -- you probably -- seems like you've done your homework. There's the SERA-17 Group that's operated in the last 20 years, and we even can't come to some conclusion. The number that we have pointed to is 200 parts per million, but there's -- it's that buffer, you know. 11:55AM 11:55AM
**Q Even 200 parts per million is below the 300 pounds per acre, is it not?**
A 200 parts per million would be --
**Q 260?** 11:55AM
A Something like that, yeah.
**Q Is part of that debate the economics of disposing of waste?**
A Yeah. I think it comes down to a sustainable system, and a sustainable system definition includes some kind of economics and harm to the resource, harm to community, harm to whatever, and scientifically, just so you understand, scientifically I don't think you can do this. I don't think you can come up scientifically and point 11:56AM 11:56AM

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to a number and say that's the number because every soil is different, and that's a fact. There's no question about that, and it comes down to somewhat of a consensus of science on how, you know, we know this, we know that, let's do the best we can here, but to come out and say I can mathematically tell you this is how to do it, the science isn't there. 11:56AM
**Q Looking at the Illinois River watershed, the water bodies like Tenkiller and the main river, one can see that there's been harm as a result of excessive waste; would you agree?** 11:57AM
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
**Q I'm saying one can look at -- I'm talking about scientists.** 11:57AM
MR. McDANIEL: Object to the form.
A I would defer to my colleagues, Haggard and Matlock and others, on that because I'm not a -- I've asked that question myself, and I'll defer to them. I don't have a perspective of -- yes, go ahead. 11:57AM
**Q Well, that's fine. I want you to be finished.**
A I am.
**Q With regard to the soils, we know there's a range there, and at this point, at least based upon** 11:57AM

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**your own statements, the Arkansas scientists have agreed that 80 to 100 pounds under the Mehlich III is that range; would you agree?**

MR. McDANIEL: Object to the form.

A We have agreed and we still stick by that statement. Whatever that number we say in terms of upper limit, I mean that's a fact. I mean -- 11:57AM

**Q And that range of 80 to 100 is the upper limit that you are speaking to, is it not?**

A Upper limit in terms of response to forages. 11:58AM

**Q And I'll use an exaggerated number but let's say you put on 400 pounds.**

A Uh-huh.

**Q When the plant takes up only that which it needs and you have the rest as excess, and I'm giving you credit, we don't know what that number is for purpose of this question, but that excess is simply being discarded, is it not?** 11:58AM

MR. McDANIEL: Object to the form.

A Discarded, what do you mean? 11:58AM

**Q It's not being used by the grass, the crop; correct?**

A No.

**Q It's not being used in the poultry growing operation any longer because it's been thrown out on** 11:58AM



**the field; correct?**

A Right.

**Q It goes someplace, doesn't it?**

A Uh-huh.

**Q And when it goes someplace, right now we're seeing it go into water bodies on runoff; correct?** 11:58AM

MR. McDANIEL: Object to the form.

MR. GEORGE: Object to form.

A Not totally.

**Q Okay. I'll give you that.** 11:59AM

MR. McDANIEL: Rick, you need to let the man finish his answer.

**Q Not totally?**

A Not totally. I mean when you apply manure, some -- if you are going to get runoff, some runoff will occur and some will be taken up. Majority of that will be in the organic form, but that which is inorganic will be absorbed by the soil. 11:59AM

**Q Notwithstanding, your papers, and we've looked at several quotes from your papers, point out that the phosphorus runoff to water bodies can increase eutrophication, which leads to various problems; correct?** 11:59AM

A Right, yes.

MR. GARREN: Why don't we take a lunch break and we'll come back and wrap this thing up. 12:00PM



VIDEOGRAPHER: We're now off the Record. The time is 12:00 p.m.

(Following a lunch recess at 12:00 p.m., proceedings continued on the Record at 1:36 p.m.)

VIDEOGRAPHER: We are back on the Record. The time is 1:36 p.m.

**Q Dr. Daniel, we're back after our lunch break. I'll remind you you are still under oath, and I've placed in front of you Exhibit No. 10. This is an article entitled indicator bacteria concentrations of two northwest Arkansas streams in relation to flow and season, and there were several authors, co-authors on this, including yourself. Do you remember doing this work?** 01:36PM 01:37PM

A I do vaguely, yes.

**Q It shows that it's published by or for the American Society of Agricultural Engineers with a copyright of 1997. Would that be roughly the time that it in fact was published?** 01:37PM

A That was the time it was published. It was probably done in '94 or '95.

**Q Okay. I was going to ask you about that. That one incorporates some of your work. In fact,** 01:37PM



**it's Page 104 of the article, which is the second page, the Moores Creek and Beatty Branch area that I think you mentioned earlier that you had knowledge of?**

A Yes, they were sub -- yes. 01:37PM

**Q Subwatersheds of the Illinois River watershed; correct?**

A Yes.

**Q Those are located in the Arkansas area by Lincoln Lake as I see in this article; true?** 01:37PM

A Yes.

**Q Near the bottom right-hand corner, the very last sentence of that first page it states, the transport of FC and FS. That's defined as fecal coliform and fecal streptococcus, right?** 01:38PM

A Yes.

**Q Is that what you are referring to?**

A Yes.

**Q The transport of FC and FS in runoff from source areas, such as pasture, ranch land and forest, has been amply documented in reviews on the subject by Crane in 1983. Have you yourself done any work in this area?** 01:38PM

A No.

**Q Describe, if you would, what was your** 01:38PM

**contribution to this article then that we're looking at or this paper.**
A I worked with Dwayne on the watersheds, setting them up because we had had some experience with that and watersheds in Wisconsin, assisted in -- kind of as a backup for sampling, just a collaborator in expertise. This is written after he went to Kentucky.
**Q The opinions and comments concerning fecal coliform and fecal streptococcus, would those be in part yours or someone else's then?**
A Well, they would be primarily Dwayne's but since I'm a co-author, I would have to take some responsibility there.
**Q Let's look at the conclusions of Page 108 of the document and just ask about a couple of those.**
A Sure.
**Q The second paragraph under the heading summary and conclusions, beginning both FC and FS concentrations were significantly affected by the time of the year during which samples were collected. It goes on to say, the highest concentrations were observed during the summer months, and it goes on to talk about flow rates. Did you obtain data yourself in determining this**

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**conclusion?**
A I didn't personally do it. This was done by automatic water quality samplers, and then these were taken in and analyzed at the lab.
**Q And did you participate in any of that aspect of the bacteria portion of this article in rendering opinions?**
A To some degree, yeah, I mean not -- that wasn't high on their chart. I can remember us trying to sort out -- trying to sort out why that was occurring and where it may be coming from.
**Q When it says that the transport of fecal coliform and streptococcus in runoff is amply documented, what would that mean to you?**
A I would assume that meant that there was a review article by Crane on the subject matter.
**Q All right, and is that a generally recognized opinion today still?**
MR. McDANIEL: Object to the form.
A I'm pretty sure that that's probably -- the technology has advanced considerably since then on the methods of analysis. Fundamentals may be correct but I'm sure the technology has advanced.
**Q But you don't know of any technology advancements that would render this statement that I**

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**just read as incorrect, do you?**
A Not really. I mean what we're seeing is that the transport of fecal coliform and streptococcus in runoff sources areas -- source areas such as pasture land has been amply documented. I imagine there's more added to it.
**Q Let me hand you now Exhibit No. 11.**
A Uh-huh.
**Q This is an article for the Journal of American Water Resource Association in April of '97, co-authored by you, along with others as we see on the title there, and it's called fecal coliform and streptococcus concentrations in runoff in grazed pastures in northwest Arkansas, and you assisted in obtaining information relative to this paper I assume then?**
A Yes.
**Q It says in the second or in the first paragraph in the right-hand column on the first page, animal manures contain numerous pathogens that are potentially harmful to humans. I think we've talked about it earlier. That's widely known at this point, is it not?**
A Yes.
**Q And has been for years; correct?**

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A Uh-huh.
**Q Answer verbally for me.**
A Yes. I'm sorry, excuse me.
**Q Thank you. It appears from the citation in that statement that we have some reports as early as '74 and 1976 from various authors which was relied on in making that statement in that first paragraph?**
A Yes. We did leave out -- Paccullough is not listed in the references. Excuse me. Ellison. Excuse me.
**Q When we talk about animal manures that are referenced here, would that include poultry?**
A I wouldn't -- I don't really know. '97, I don't know.
**Q So when we look at the abstract, the very first sentence, agricultural practices such as animal grazing and animal manure application can contribute to relatively high runoff concentrations of fecal coliform and fecal streptococcus. You don't know whether that includes poultry in this particular reference?**
A No, I don't. Like I said, there were very limited articles on poultry litter in the '90's, '91, but I don't know.
**Q This is closer to '97. It's later in time.**

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A Probably done in '95.
**Q Let's look back at Exhibit 12 that we looked at earlier today. I think it's going to be buried in the stack. For the Record you pointed out and reminded me there have been certain annotations or underlining done on these documents in some instances. Those were done by you at points in time, not by me; is that correct?** 01:46PM
A Correct, yes.
**Q Okay. So the Record will reflect we haven't purposefully highlighted something. You have Exhibit 12 in front of you?** 01:46PM
A Yes.
**Q This exhibit we looked at earlier talks about the phosphorus index which we have alluded to, and I want to direct your attention to a statement that's made at the bottom of Page 477 of the article under screening tool. Let me read it and we'll talk about it. It says, developing an index value for a field can be inefficient because it is labor intensive effort, necessitating a site visit and other efforts to compile the required input parameters. This is especially true if the likelihood of that field is low priority. Therefore, it may be impractical and unnecessary to calculate the index for all fields.** 01:47PM 01:47PM 01:48PM



**Generally tell me what is meant by that statement.**
A I think places like Delaware, Maryland decided that they wanted to use a screening tool to not have to do every field, and their manpower shortage, et cetera, and they were trying to streamline it just trying to be as effective as they can. We don't recommend that. We want people to go out into the field and actually have an on-site visit. 01:48PM
**Q That was my question follow up to you, is that in the IRW that's probably not a good recommendation, is it?** 01:48PM
A No.
**Q We talked earlier about the use of the index, and I'd like to ask you this: You might recall you wanted to defer to your colleagues about whether the water quality in the IRW was impaired or impacted. Do you remember that line of questioning?** 01:49PM
A Yes.
**Q Is there scientific consensus at which point with using an index no runoff occurs?** 01:49PM
A Is there scientific consensus that no runoff will occur?
**Q Yes, sir.**
MR. McDANIEL: Object to the form.
**Q In relying on a phosphorus index?** 01:49PM



MR. McDANIEL: Object to the form.
A No runoff occurs? I don't know -- I don't know of any, but I guess that could occur on a very sandy soil.
**Q As I understand it, the phosphorus index is a risk-based assessment; is that a correct statement?** 01:49PM
A Yes.
**Q In understanding that risk, isn't it important that the -- that one would know the poultry waste that actually has gone into the streams in order to set a standard?** 01:50PM
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
A I'm going to see if I can answer your question. In the phosphorus index, the risk of phosphorus leaving that field, part of that risk assessment in most indexes is its potential for runoff. Some soils have, as we said, very little runoff and some high runoff, and that's how that is calculated into the index. 01:50PM 01:50PM
**Q But at some point that index doesn't necessarily assure us no runoff will occur, does it?**
MR. McDANIEL: Object to the form.
A No, no.
**Q No, that's correct?** 01:51PM



A No, it doesn't assure you that no runoff will occur.
**Q Okay.**
A You can -- let me clarify that. On any of these things if you have the Noah's flood, it's -- you know, you're going to have runoff. 01:51PM
**Q You've taken that to the extreme, of course, when you talk about that?**
A Sure, right.
**Q But at some point some runoff can occur even in reliance on a phosphorus index as we see in Arkansas?** 01:51PM
A Yes. The phosphorus index is not a predictive tool in terms of runoff nor phosphorus loss.
**Q Let me ask you this as a practical matter: In looking at that index and the calculations that it requires, is that something you intend that a farmer would have to deal with?** 01:51PM
MR. GEORGE: Object to the form.
A The original intent of the index was to and still is, is it be -- served several functions. One of them is to assess the relative risk of phosphorus from that particular field, but once that risk has been assigned, is then to sit down with the grower and go over with them what are the factors, is he 01:51PM 01:52PM

putting out too much, et cetera, and also as an educational tool to the grower.

**Q That would be, as I understand it, of course, the index would be used in conjunction with soil testing of those fields; correct?** 01:52PM

A Correct.

**Q And do you -- is it my understanding that even in reliance on the phosphorus index, continued soil testing will occur for these individual fields; correct?** 01:52PM

A Yes.

**Q But the actual -- what I'm getting at is, is the index something that we would rely on a farmer in order to calculate or someone like an NRCS or some other scientific organization to make those calculations?** 01:52PM

A I'm sorry. Of course, it's done by the professionals in the field. Many times it's the NRCS employee. Most times it's the district employees. 01:53PM

**Q And we have to then rely on those people to communicate effectively to a farmer who will hopefully understand and apply its benefits; correct?**

A Correct. 01:53PM



**Q If a phosphorus index is being used for a particular farmer or grower and you take soil test samples, calculate it, come back the next year and find that maybe soil test phosphorus is higher than it was the year before, what would you conclude from that?** 01:53PM

MR. GEORGE: Object to the form.

A First of all, that would not surprise me. It could be higher or lower. Sampling soil is a very erratic -- it's a very difficult process. Now, if 01:54PM it was ten times higher, that would be a different -- you know, maybe like taking your blood pressure, you know. Generally you don't want it to be 190 but the soil test does give you an indication of history of land application. 01:54PM

**Q Do the kind of soils we see in the IRW complicate the ability to take soil samples also?**

A In some cases, yes, because there are -- generally you take a zero to four-inch sample. In some cases our experience in Eucha-Spavinaw where 01:54PM they are required to sample every year, it's hard to even get zero to four inches of soil.

**Q Is there a recommendation at which there should be a minimum amount of soil before poultry waste application should occur?** 01:55PM



A No, not that I know of.

**Q Should there be do you think?**

A That ought to be looked at pretty carefully. You would think if you don't have much of that, you shouldn't be applying anyway, but just to reiterate, 01:55PM soils in northwest Arkansas are very cherty, and so by the nature of that, they are -- they can vary from -- there's many articles on that.

**Q And because they are cherty, full of rocks, that's part of my question, that probably** 01:55PM **complicates the ability to take a good soil sample or an accurate soil sample?**

A You probably have to take more, and I think even OSU scientists have noted the variability and they're seeing that -- I think this is right. 01:56PM They're saying that 50 parts per million is the upper limit of soil where you get a response, but there's such variability within the field that in order for all the fields to be over that 50, they will basically double that and make it up. 01:56PM

**Q That has to do with variations in application rates?**

A Uh-huh.

**Q Obviously sometimes in slight differences of soil you talked about earlier today that might exist** 01:56PM **in the same field?**

A Yes.

**Q That's part of those factors?**

A Yes.

**Q All right. Let's look now at Exhibit 13, if** 01:56PM **you would, please. This is another article in which you co-authored called nutrient input and removal trends for agricultural soils in nine geographic regions in Arkansas. I don't know that it's dated but it shows that the study occurred in these** 01:57PM **geographical districts within Arkansas from 1997 to 2001. Do you recall participating in this?**

A Yes.

**Q The very first line after the abstract talks about kind of the thrust of what's needed here. It** 01:57PM **says, a fundamental component of developing nutrient management strategies is to determine the balance between nutrient inputs and outputs to identify areas where soil nutrient inputs are greater than removals. Tell the court in kind of lay terms what** 01:57PM **that means.**

A Well, take it on a -- let me read it first.

**Q Okay.**

A Okay. Basically it means that a budget of nutrients coming into an area and the nutrients 01:58PM

going out of that area.
**Q And is it fair and correct to say the goal would be that those would be equal, balanced?**
MR. McDANIEL: Object to the form.
A In an ideal world that might be the case, yes, as long as -- well, I'll leave it at that, yes. 01:58PM
**Q In the right-hand column at the bottom of this article, the paper states, nutrient management issues, i.e., accumulation and deficiencies, that threaten environmental quality, the productivity of agricultural lands or both are generally reacted to rather than anticipated. That seems to say that until something happens that's identified as maybe harmful, things aren't being done; is that a fair statement?** 01:59PM
MR. McDANIEL: Object to the form.
A I guess you could see it that way.
**Q Tell me how you see or might rephrase it --**
MR. McDANIEL: Just a second, Rick.
MR. GEORGE: Let him -- 01:59PM
MR. GARREN: I apologize.
A I don't know what -- reacted to, I don't know, but if I read that, it would seem to say that it was -- I mean if I wrote that, it would seem to say your -- that your -- you really don't -- nutrient 02:00PM

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management issues -- well, I don't know what is meant by nutrient management issues, although I am an author, but I think what it says or what I would interpret that to say is that -- is that we -- we're not going to -- we have not responded and had the foresight to look ahead. 02:01PM
**Q Would that in your opinion apply to the region in Arkansas known as the Illinois River watershed?**
MR. GEORGE: Object to the form.
A Well, I think, I think, no. I think we have recognized that we have an opportunity to utilize the litter, and the best use of the litter would be to get it to an area like the delta. I've got a grad student on reformulating that. So it's not that we haven't thought about this. 02:01PM
**Q And that's -- putting this in perspective with regard to the presence of the poultry industry, that's more of a new found phenomenon, that recognition of moving the litter to another place, is it not?** 02:02PM
MR. McDANIEL: Object to the form.
A I can't speak for the industry. I don't know what they're thinking.
**Q Oh, okay. I maybe didn't word that sufficiently enough to understand what I said. I'm talking about in essence of time, that the poultry industry has been in northwest Arkansas for quite some time; would you agree?** 02:02PM
A Yes.
**Q And as you've mentioned earlier in an article, there's been a great growth and rise in the poultry industry over a period of time?**
MR. McDANIEL: Object to the form.
**Q Do you agree?**
A Yes. 02:02PM
**Q And my point is, it's only been recently have we recognized the need to do something about the poultry litter in reference to the total of time it's been going on?**
MR. McDANIEL: Object to the form. 02:02PM
A Well, I wouldn't say that because we formed -- nationally we formed programs to try to develop research on this. Now, if you are speaking of the University, I don't know, but I know the scientists have been working on this a long time and in the early '90's trying to deal with issues. If we're doing it in the Illinois River, we're doing it everywhere else, and I'm not sure I understand your question. 02:03PM
**Q Okay. Fair enough.** 02:03PM

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A You can restate it and I'll try again.
**Q I'll move on because I don't want this to sound like I'm having an argument about what this means.**
A No. I'm trying.
**Q I'm trying to get your understanding of what was written in an article that you co-authored and how that applies to the IRW. That's simply what I was trying to get to. Let me ask you then, if we go to the next page, it says in the first full paragraph, in 2003 Arkansas ranked high among all U.S. states in agricultural production, and it talks about it was second in broiler and third in turkey. Were you aware of that --** 02:03PM
A Yes. 02:03PM
**Q -- when this was done?**
A Yes.
**Q Okay. This whole article talks about the nine zones that we see, the geographic regions that are exhibited on the map of Page 1607 of this Exhibit 13. Area No. 1, which is the Benton and Washington Counties, which is where most of the IRW sits or half of it in Arkansas; would you agree?** 02:04PM
A Yes.
**Q And do you know what the population of birds** 02:04PM

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**grown in that area is specifically in relation to other areas of the state of Arkansas?**
A Well, I would -- if you can accept a relative term, I would say it's high, probably one of the most populated poultry counties in the state. 02:04PM
**Q Let me hand you -- and this is something you haven't seen but let me hand you Exhibit 14 and just take a moment to look at that. I want to, I think through this, confirm what you just said. This is an Arkansas Natural Resource Commission report that 02:05PM reports among other things, but in this case has total amount of birds, and you can see Benton and Washington County and the total number of birds and population that's reported on this report. They do appear to be the greatest of all other counties in 02:05PM that state, don't they?**
A Correct.
**Q Moving back to your article in Exhibit 13, tell me what is the Arkansas Agricultural Statistics Service? 02:05PM**
A It is a division of the agriculture, University of Arkansas agriculture.
**Q As part of the University?**
A It's my understanding they are. Now, they're probably in cahoots with the state organization 02:05PM



A Yes, sir.
**Q It goes on to say further down, nutrients derived from excreted dairy and hog manures represented a relatively insignificant amount of the total nutrient inputs, and perhaps not all of these 02:07PM manures are actually collected and transportable. Is this something that Mr. Slaton would have to tell us or do you know that?**
A Well, I think what we're saying there is basically the dairy, the quantity of dairy and swine 02:08PM is insignificant relative to poultry.
**Q All right. The last sentence in that column begins, although a significant proportion of the soils used for forage production has excessive soil test P, 15 to 20 percent of those soils do have low 02:08PM to medium soil test P and could probably handle nutrients from hog and dairy production. That apparently is based on Mr. DeLong in 2003. Is that fairly accurate even today with regard to essentially 80 to 85 percent of the soils having 02:08PM excessive P levels?**
MR. McDANIEL: Object to the form.
A I think this Mr. -- Dr. Slaton is a fertility guy and he looks at it from a fertility standpoint. So I would guess that he's speaking in terms of 02:08PM



also, but I know that this is the group that we go to to obtain the stats on that, and that's probably two or three years dated; in other words, I think you wouldn't get the 2007 data because they're collecting it. 02:06PM
**Q Right.**
A It's kind of what we rely on for these things.
**Q Okay, and it's acceptable in your scientific community to rely on those statistics?**
A Yes. 02:06PM
**Q All right. Moving over to Page 1610 of the report in the first -- in the left-hand column in the first paragraph there it says -- actually the second sentence, poultry litter accounted for 92, 96 and 92 percent of the total manure-derived nitrogen, 02:06PM phosphorus and potassium respectfully in this analysis for Arkansas. Data not shown. Do you know what would be the source of that data?**
A I do not. I read that last night and I did not understand that either. 02:07PM
**Q Okay.**
A It says data not shown, so he must have -- Nathan must have got that.
**Q Is that who we would look to to find the source, Nathan Slaton? 02:07PM**



required to produce forage yield. Yeah, apparently somewhere there must be data -- must be referring to the Illinois River -- I mean northwest Arkansas. I mean, he would have that data. Yeah, he's got that data. 02:09PM
**Q And you don't know, sitting here today, whether or not the soils he's referring to have excess phosphorus levels equal to approximately 80 to 85 percent?**
A I don't know; I do not know. He is the 02:09PM repository of the soil test information that's in all the state but particularly Washington, Arkansas and Benton, and all soil tests are sent in, and we can't separate a soil test from my lawn or a 500-acre grower. 02:10PM
**Q That's part of the system at least I'm thinking kind of falls apart, doesn't it?**
A Sounds like it ought to be changed.
**Q In order to be able to identify these areas where an index might be useful, you kind of need to 02:10PM know the areas that perhaps on could occur?**
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
A Well, I think we would be better served if we were to make some distinguished -- make some effort 02:10PM

at trying to know, you know, if your soil test P in lawns or gardens are high, we need to know that, but we can't -- as far as I know, we can't separate that out.

**Q Over on the next page, 1611 of this Exhibit 13, under the column net nutrient balance, the last sentence makes this conclusion: Therefore, a major portion of poultry litter would have to be transported outside of the western district to establish a balanced situation for phosphorus. Do you have that same opinion; is that your opinion?** 02:11PM

A It depends on if -- if your -- I guess if you are referring to phosphorus, it would be the case.

**Q And that's what this is referring to I believe, is it not?** 02:12PM

A Yes.

**Q Under the portion on Page 1612 looks like that second sentence it shows, our data show that poultry production produces the majority of excess collectable and transportable nitrogen and phosphorus in western Arkansas. Is that something you know to be true from this study and work?** 02:13PM

A Yes.

**Q When you say excess collectable and transportable nitrogen and phosphorus, what does that mean?** 02:13PM



A You know, you collect it out of the house and you can transport it.

**Q Okay. Is that -- this article I believe was published in '90 -- I'm not sure we have a date on this one.** 02:13PM

A '97.

**Q Okay. Well, actually the study was conducted in '97 and 2001, so it would be a published date after 2001.** 02:14PM

A Okay, sorry.

**Q So that's relatively recent in time. Do you know whether or not this is applicable for any other time period other than the study?**

A I think the findings would apply to previously. 02:14PM

**Q Previously, and would probably apply -- well, it would apply today; would you agree?**

A Uh-huh.

**Q Verbally yes?** 02:14PM

A Yes. Sorry. Excuse me. Now, I'll just also say that I'm not exactly sure what Nate is basing excess on, whether it's the excess of -- fertility excess over the 50 or if it's just the balance. I assume it's just the balance. 02:14PM



**Q The balance over the 50?**

A No. Just coming in, going out. I think he says in here somewhere one to nine kilograms right there is excess.

**Q Page 1613 of this document it shows under conclusions that the greatest excess of nitrogen and phosphorus exists in District 1, which is farthest away from the row crop producing area in eastern Arkansas, and we can see from the map in the article that or paper that No. 1 includes Benton and Washington Counties?** 02:15PM

A Right, yes, sir.

**Q The last page of this document or next to the last page, Page 1614, it says, second paragraph, the results from this assessment may help reinforce the thought that current nutrient application strategies in western Arkansas are not sustainable without the danger of creating and/or exacerbating water quality issues from excessive nutrients. Explain to me what you think that says.** 02:16PM

A I think that says that there's too much phosphorus.

**Q Would the area that this last statement we read include the northwest Arkansas area to your knowledge?** 02:17PM



A Yes. It's in Group 1.

MR. GARREN: I'll pass the witness.

MR. GEORGE: Let's take a quick break.

VIDEOGRAPHER: We are now off the Record. The time is now 2:18 p.m. 02:17PM

(Following a short recess at 2:17 p.m., proceedings continued on the Record at 2:25 p.m.)

VIDEOGRAPHER: We are back on the Record. The time is 2:26 p.m.

CROSS EXAMINATION

BY MR. GEORGE:

**Q Dr. Daniels, my name is Robert George. I represent Tyson Food. I have a couple of questions just to follow up on some of the questions that were asked by Mr. Garren. If you'll indulge me, I would appreciate it. Let's start with the exhibit you last left off on, which is Exhibit 13. You were asked some questions by Mr. Garren about Exhibit 13, which you are a co-author of; correct?** 02:26PM

A Correct. 02:26PM

**Q Who did the bulk of the work?**

A Nathan Slaton.

**Q Okay, and is Nathan Slaton the same Nathan you referred to earlier as the fertilization expert at the University?** 02:26PM

A Correct.
**Q And he would be the same gentleman who is working on some research that he's yet to publish regarding the agronomic levels associated with phosphorus; is that correct?** 02:26PM
A Correct, crop response and phosphorus.
**Q Thank you. Now, just one point of context on the article that is Exhibit 13, is this a study that is specific to the Illinois River watershed?**
A No. It's for the -- actually the counties that's indicated in Figure 1. 02:27PM
**Q It looks at nutrient issues across the entire state of Arkansas; is that right?**
A Yes.
**Q And even some of the statements that you were asked about regarding districts in the western part of the state, do you recall that line of questioning?** 02:27PM
A Yes.
**Q Are any of those districts married up geographically with the boundaries of the Illinois River watershed; do you understand that question?** 02:27PM
A Yes and no. Restate it.
**Q Let me refine it a little bit. It was a poor question. For example, let's go to the map.** 02:27PM



**District No. 1, which consists of six different counties; is that correct?**
A Yes.
**Q Okay. Are all six of those counties in the Illinois River watershed?** 02:28PM
A No.
**Q How many are at least partially in the Illinois River watershed?**
A To my knowledge I think Benton and Washington.
**Q And do you agree that neither of those two counties are entirely within the watershed?** 02:28PM
A Correct.
**Q Now, if you turn to Page 1612, you were asked some questions about the second sentence under discussion regarding the data showing poultry production produces the majority of excess collectable and transportable N and P in western Arkansas; do you recall that?** 02:28PM
A Yes.
**Q What types of nutrient sources to your knowledge would not be included in this study's definition of collectable and transportable N and P?** 02:28PM
A Probably sludge.
**Q Sewage sludge?**
A Uh-huh. 02:29PM



**Q What else would be excluded from that definition?**
A I'm not certain about this but I think that probably would include dairy and swine waste.
**Q What about wildlife; is wildlife for purposes of this analysis collectable and transportable N and P?** 02:29PM
A No, not in my opinion.
**Q The human waste that is discharged from POTW's, would that be considered collectable and transportable N and P?** 02:29PM
A The sludge would be.
**Q The sludge?**
A Yeah.
**Q So you are making a distinction for purpose of the definition used in this study between sewage sludge and the actual discharge out of a pipe; correct?** 02:29PM
A Yes.
**Q So this study and its analysis regarding nutrient inputs does not take into account point source discharges?** 02:29PM
A No.
**Q Nor does it take into account the contribution to the nutrient balance from cattle or wildlife?** 02:29PM



A No. Just strictly litter the way I understand it.
**Q Turn to Page 1610. I'm going to ask a couple of questions. In the left-hand column you were asked about the sentence that says poultry litter accounted for 92, 96 and 92 percent of the total manure-derived N, P and K represented in this analysis for Arkansas. Do you recall that question?** 02:30PM
A Yes.
**Q Can you tell me with respect to those percentages what geographic area is being described?** 02:30PM
A I cannot. I will have to talk to Mr. Slaton about that one.
**Q So you are not suggesting by your testimony earlier that this sentence establishes or supports the notion that 92 or 96 percent of the N, P and K in the Illinois River watershed is represented by poultry litter?** 02:30PM
A No. I'm saying I don't know where those numbers came from and -- no. 02:31PM
**Q Similar question, in the left-hand column, the very last sentence and it carries over to the right-hand column, you were asked about the statement that a significant proportion of the soil tests used for forage production has excess soil** 02:31PM

**test P in 15 to 20 percent of these samples. Do you recall that?**
A Yes.
**Q Again, geographically do you know whether that is a state-wide figure or something that is confined either to the Illinois River watershed or the western side of Arkansas?** 02:31PM
A It's certainly confined to the area that -- in Arkansas.
**Q In Arkansas?** 02:31PM
A Yes.
**Q But you're not sure if that's a number that is reporting the percentage of excess phosphorus soils in the western district or the eastern district?**
A It says forage production. I'm assuming he's referring to the area where forage is produced and that would be the eastern section, primarily the number one. 02:31PM
**Q Okay. Last question on this document, Dr. Daniels, the sentence that you were asked about on Page 1614 in the conclusion that provided that the results from this assessment reinforced the thought that current nutrient application strategies in western Arkansas are not sustainable without danger of creating or exacerbating water quality issues** 02:32PM



**from excess nutrients. Do you recall that?**
A Right.
**Q When was this paper published?**
A It says 2004, September 2004.
**Q And do you recall -- I assume you completed -- you and your co-authors worked on this paper sometime prior to it being published, of course?** 02:32PM
A Right, probably 2002.
**Q Okay. Since 2002 have there been changes on the Arkansas side in terms of the way in which poultry litter is managed from a regulatory standpoint?** 02:33PM
A Yes. I think the -- I'm not sure whether in 2002 whether the index was a requirement or not, but it is now, and also I understand that certainly our experience in the Eucha-Spavinaw watershed is that hauling has been very popular and very successful. 02:33PM
**Q And those are all developments that post date this observation in Exhibit No. 13?**
A Yes. 02:33PM
**Q You mentioned the phosphorus index. Let's go to I think it was Exhibit No. 12. I'm a little bit out of order. I'm not sure if you kept yours in order.**
A He did. 02:34PM



**Q The title of this paper is the phosphorus index background and status; correct?**
A Correct.
**Q And I think you've told us earlier that even though this is undated, that you recall generally when this was published?** 02:34PM
A Yes.
**Q Do you remember when that was? I've forgotten.**
A Let's see if I can say the same thing I did before. I'm guessing it's in the late '90's, mid to late '90's. 02:34PM
**Q And you told us in your testimony earlier that a phosphorus index is a risk-based tool that's used by a lot of both scientists and regulators in managing poultry litter application; is that correct?** 02:34PM
A Correct.
**Q Have you looked at the extent to which the concept of a phosphorus index has been embraced by various states across the country?** 02:34PM
A Yes.
**Q Could you tell us generally the acceptance of a phosphorus index?**
A I don't know the exact numbers but I think it's like 96 percent of the states have accepted the phosphorus index as their management tool. 02:35PM
**Q And included in that 96 percent would be both the state of Arkansas and the state of Oklahoma; correct?** 02:35PM
A Certainly the state of Arkansas. I think the state of Oklahoma have what they call an index but it is basically based on soil test P.
**Q And do you recall or do you have knowledge of the threshold level of soil test P in Oklahoma which is acceptable under their litter application standards?** 02:35PM
A I believe they have two numbers, one for impaired watersheds and unimpaired. The -- I'm guessing here but I think one is -- the impaired watershed is 300 pounds per acre in a zero to 60 sample. I think that's right; I'm not sure. 02:35PM
**Q Look at Exhibit No. 12. The paragraph under the heading relating soil and runoff phosphorus -- there are actually two paragraphs. I want to focus on the last sentence. Could you read the last sentence?** 02:36PM
A Therefore?
**Q Yes.**
A Therefore, soil P levels alone have little 02:36PM

meaning vis-a-vis P loss potential unless you -- they are used in conjunction with an estimate of potential transport, i.e. surface runoff, erosion and leaching.

**Q Can you help me understand what that means?** 02:36PM

A Basically what we're saying is that my position on this is that soil test P alone is a very easy, very good way of dealing with manure management because you can go -- theoretically you can go measure it, but it's not -- it is not 02:36PM necessarily the best way but you can on some soils have high soil test P -- I mean low soil test P and a high risk. So what we're saying is that we need to combine the two.

**Q Which two? I'm sorry.** 02:37PM

A Threshold, a cut-off level and the phosphorus index in concert.

**Q You were asked some questions about agronomic requirements of certain crops and there was a discussion about how much phosphorus a particular crop might need. Are you, sir, of the opinion that the most science-based method for dealing with poultry litter application rates would be an agronomic rate?** 02:37PM

A No, because I think there are some that -- 02:37PM



there are some additional things that you get from litter besides phosphorus. The question is, how far does that go up on the scale of STP.

**Q Okay. What are some of the additional agricultural benefits associated with poultry litter beyond phosphorus?** 02:37PM

A Well, certainly organic matter content, you're adding some micronutrients, but Nathan has done work on this and he would be much better, but there are definitely some. For example, in the delta we can 02:38PM take, and he has done this, can take side by side plots where you put out litter and where you match that same nutrient rate with a commercial fertilizer and the litter plots will substantially out yield the commercial fertilizer, and we have no clue why 02:38PM that is. Micronutrients, who knows.

**Q And those benefits beyond just the introduction of phosphorus as a nutrient are present with litter applications that occur even above the agronomic rate for phosphorus for a particular crop; is that correct?** 02:38PM

MR. GARREN: Object to the form.

A Yes.

**Q So then from your own work and experience, you would agree, would you not, sir, that there are benefits to land applying poultry litter even on a field where the STP levels for phosphorus are at or above the agronomic rate?** 02:39PM

A Yes, and for the Record, if you're at 55 parts per million and you go to 56 or 60, that doesn't 02:39PM mean that, you know, it's a drop dead and you're -- it's where does that on that scale -- and I don't know where that is -- where does that become a detriment, and that's the $64,000 question.

**Q Turn to Exhibit 4, which I think is another paper, Professor Daniels, that you've co-authored.** 02:39PM

MR. GARREN: What's your cite?

MR. GEORGE: Exhibit 4. Sorry.

A Yes, sir.

**Q It's an article entitled poultry manure management, environmentally sound options; correct?** 02:40PM

A Correct.

**Q Would you turn to the Page 324 of that article?**

A Yes, sir. 02:40PM

**Q On the left-hand column towards the bottom there is a rather long sentence that begins with soil properties; do you see that?**

A On 324 left-hand column?

**Q Yes, sir, all the way to the bottom beneath the heading agronomic and environmental effects.** 02:40PM

A In addition to benefits?

**Q Yes. Could you just read that?**

A In addition to benefits that poultry litter and manure provide to crop production in the form of 02:41PM nutrients, these carbon bearing materials can build soil organic material reserves, which benefit crop production via increase in soil-water holding capacity, water infiltration rate, cation exchange capacity and structural stability. 02:41PM

**Q Are these some of the additional benefits beyond just nutrient value that you were discussing that are recognized with regard to poultry litter?**

A Yes.

**Q And you have those benefits present even when you are land applying beyond the soil test phosphorus agronomic levels; correct?** 02:41PM

A Yes. I guess the other thing we forgot to put there is litter has a liming capability.

**Q Explain what you mean.** 02:42PM

A Litter in itself has a pH of about 8.3, and when applied to land over long terms, you will evidence a pH increase. Normally our soils in this area are naturally acid, about 4 or 4.5, which is not good, and best production is around 7 and so 02:42PM

litter -- long-term application of litter will raise the pH into that optimum range.
**Q And that would be another benefit associated with land application of poultry litter?**
A Yes. I think one of the major concerns of the growers, should they not be able to use the litter, is both liming and nitrogen application. 02:42PM
**Q And I assume this liming benefit would be reaped even in land applications on soils where you have a soil test that reports the agronomic needs for phosphorus are already met?** 02:43PM
A Yes.
**Q So is it your opinion, sir, that there are legitimate reasons to land apply poultry litter even when the agronomic requirements for phosphorus are satisfied on a particular field?** 02:43PM
MR. GARREN: Object to the form of the question.
**Q Go ahead and answer.**
A Yes. 02:43PM
MR. GEORGE: Let's take a break. We're supposed to change out a tape.
VIDEOGRAPHER: We're now off the Record. The time is now 2:43 p.m.
(Whereupon, a discussion was held off the Record.) 02:43PM

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VIDEOGRAPHER: We are back on the Record. The time is 2:44 p.m.
**Q Dr. Daniels, I assume from the exchange we just had that you are not offering an opinion in this case that poultry litter applications in the Illinois River watershed should be or need to be limited to the agronomic needs of crops for phosphorus?** 02:44PM
MR. GARREN: Object to the form. 02:44PM
A No, I'm not.
**Q You're not offering that opinion?**
A I'm not.
**Q In fact, isn't it your understanding, sir, that the current phosphorus indexes as configured in Arkansas and Oklahoma applicable to the Illinois River watershed permit the land application of poultry litter beyond the agronomic needs of crops for phosphorus?** 02:44PM
MR. GARREN: Object to the form. 02:45PM
A Yes.
**Q Can you turn to Exhibit 5, sir, which is another article that you are a co-author on entitled effects of poultry litter application rate and rainfall intensity on the quality of runoff on fescue grass plots?** 02:45PM
A Yes, sir.
**Q The sentence that begins the bottom of the left-hand column on Page 361, poultry litter is no different; do you see that?**
A Yes. 02:45PM
**Q I'll just read it. It says, poultry litter is no different from other fertilizers, both organic and inorganic, in that litter constituents may be lost from application sites in runoff from intense storms. Do you see that statement?** 02:46PM
A Yes.
**Q Do you still agree with that statement?**
A I do and, in fact, that's '93. Since then Dwayne and others and myself have shown that actually if you are going to apply litter, land apply litter at the same phosphorus rate of let's say 40 pounds per acre and commercial fertilizer at 40 pounds per acre of P, the commercial fertilizer is a significantly higher runoff than litter. 02:46PM
**Q Why is that; do you know?**
A Because the commercial fertilizer by law when it's listed as, you know, 10-10-10, that has to be -- that quantity has to be water soluble, and in the litter itself, there's a lot in the organic form and maybe 6 percent in the inorganic form. 02:46PM
**Q So if I understand correctly, based on the additional research that's been done since this paper was published by you and your colleagues at the University of Arkansas, you would agree that assuming the same application rates, commercial fertilizer is a greater risk of runoff than poultry litter?** 02:47PM
A In terms of phosphorus, yes.
**Q Sir, from the conversations you've had with growers and cattle ranchers who use poultry litter, what alternative would they have if they are prohibited from using poultry litter to fertilize their forage for their cattle?** 02:47PM
MR. GARREN: Object to the form. 02:47PM
A Commercial fertilizer, purchase commercial fertilizer.
**Q While we're on cattle, let's go to Exhibit 12.**
A Yes.
**Q Which is an article that you were asked some questions about entitled fecal coliform and streptococcus concentrations in runoff from grazed pastures in northwest Arkansas. You're a co-author on that paper?** 02:47PM
A That's not 12. It's 11 maybe; is that 02:48PM

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correct? Fecal coliform and streptococcus?
**Q Correct.**
A Got it.
**Q I apologize.**
A That's all right. 02:48PM
**Q This was a study that you worked on with several others at the University back sometime prior to 1997; is that correct?**
A Yes.
**Q And in the abstract, the very first sentence references cattle grazing; do you see that?** 02:48PM
A Yes.
**Q And towards the bottom of the abstract one of the key terms associated with this study is cattle; correct?** 02:48PM
A Yes.
**Q Okay. Included within this study, were you evaluating or examining the extent to which cattle might contribute to fecal coliform and streptococcus concentrations in runoff?** 02:49PM
A Yes.
**Q And is it in fact well known within scientific circles, Dr. Daniels, that manure from cattle is a significant, can be a significant source of fecal coliform and streptococcus found in nearby streams?** 02:49PM



A Yes.
**Q Have you spent any time in the Illinois River watershed or along the Illinois River and its tributaries?**
A Horse Creek. 02:49PM
**Q Did you have occasion to see during those times in the watershed cattle having direct access to streams?**
A Yes.
**Q Are you aware that cattle sometimes defecate directly in streams; correct?** 02:49PM
A Been known to do that.
**Q Let's stay on bacteria and go to what I hope is Exhibit 10, unless my numbering is off. Should be an article entitled indicator bacteria concentrations.** 02:50PM
A Correct.
**Q This is an article that you co-authored with some others back in 1997; is that correct?**
A Correct. 02:50PM
**Q Turn to the second page, which is Page 104. In the left-hand column the first full sentence talks about the contribution of non-point sources to fecal coliform and fecal strep pollution; do you see that?** 02:51PM



A Which paragraph?
**Q I'm sorry. It's the first full paragraph on 104.**
A 104, and the contribution of non-point sources? 02:51PM
**Q Yes, sir.**
A Yes, okay.
**Q There's a discussion in that sentence about the host of variables and the sentence that follows that, influence the extent to which non-point sources can contribute to fecal coliform or fecal strep pollution; do you see that?** 02:51PM
A Uh-huh.
**Q And one of the identified variables that you're discussing in this article is microbial survival; do you see that?** 02:51PM
A Yes.
**Q What generally if you could give me an understanding of what you are talking about there and how it's a variable that needs to be considered?** 02:52PM
A Well, I think with -- it's like any organism. Given the right conditions, it will last its expected lifetime. Given not those conditions, it may perish, and I think we've shown some situations where not -- anyway, I'll answer your question. 02:52PM



Survival might mean drying up in the riverbed.
**Q Would this variable also encompass the fact that some microbes that are contained in manure that's deposited on the ground die before they ever reach a water body?** 02:52PM
A Absolutely.
**Q That's a well-known phenomenon?**
A Uh-huh.
**Q So I assume given that variable, that another fact that should be considered is the distance between where the microorganism is interjected into the environment and the receiving water body; is that right?** 02:52PM
A Correct.
**Q Down in the very last paragraph, the second full sentence says that it appears that even background fecal coliform and fecal strep concentrations in streams can exceed primary contact standards; do you see that?** 02:53PM
A Yes. 02:53PM
**Q What -- help me understand what is meant by background fecal coliform and fecal strep.**
A Well, again, I'm skating on expertise that is pretty questionable, but it's my understanding with fecal coliform is that you get a false positive even 02:53PM

from fecal organisms in the soil, and so that's a false positive, and that may be -- you may be picking up that in your background or there may be actual -- you can't distinguish between the two.

**Q Okay. Isn't it true, and if you don't know, feel free to say you don't know, but isn't it true, Dr. Daniels, that even soils that are not amended with poultry litter or the subject of cattle grazing contain some background level of bacteria?** 02:54PM

A Yes. 02:54PM

**Q Looks like one of the points of this article, Dr. Daniels, was to evaluate the relationship between flow regimes in the stream and concentrations of either fecal coliform or fecal strep; is that correct?** 02:54PM

A Correct.

**Q And then if you look over in the last -- Page 107, my reading of the study was that there was a relationship found between flow, particularly high flow conditions, and certain concentrations of bacteria; is that what you recall from this thing?** 02:55PM

A Uh-huh.

**Q Was that a yes?**

A Yes. Excuse me.

**Q Okay. The sentence in the right-hand column** 02:55PM



**right above the heading FC to FS ratios --**

A Yes.

**Q Can you read that sentence that begins with in other words?**

A In other words, sampling during periods of high flow can result in relatively high fecal coliform and fecal strep concentration even though the flow conditions at sampling do not support one or more of the stream's intended use. 02:55PM

**Q Help me understand, if you can, what was meant by the statement that high flow conditions do not support one or more of the stream's intended uses.** 02:55PM

A I'm guessing that under high flow conditions, you're going to get resuspensions of the materials in soils both in the runoff and in the stream, and then these concentrations go up. In other words -- I guess I'll stick by that. 02:56PM

**Q Okay. For context, turn back over to Page 104, the bottom -- the last sentence in the left-hand column carrying over --** 02:57PM

A If?

**Q Yes.**

A Shall I read that you're saying?

**Q Yeah, and read the next one, too, please.**

A If, for example, sufficient sampling is 02:57PM



conducted during high flow conditions presumably when non-point sources dominate, then the stream could be categorized as impaired. Significant resources might then be devoted to improving the microbial quality of the stream even though the impairment does not actually occur except at times when uses such as swimming and fishing are impractical. 02:57PM

**Q Does that help you understand the point that was made at the end about --** 02:57PM

A Yes.

**Q Tell us what your understanding is now.**

A Well, again, I think what it's saying is that when under high flow conditions, you get some resuspension of these compounds and they may indicate that they're impaired when in fact under normal use they would not be. 02:58PM

**Q And what's the significance of the last part of that last sentence about microbial quality of the stream even though the impairment does not actually occur at times when uses such as swimming and fishing are impractical?** 02:58PM

A I think what it's saying is when -- or my interpretation of what it's saying is when these numbers are high, it's due to the high runoff flows, 02:58PM



wouldn't be swimming at that time.

**Q Wouldn't be times at which there's substantial use occurring on the water body?**

A Right, correct.

**Q Because people generally don't swim in a flood; is that right?** 02:58PM

A True.

MR. GARREN: Object to the form.

**Q One last article I want to do some clean-up on, Dr. Daniels.** 02:59PM

MR. BULLOCK: Objection to the form.

**Q Exhibit No. 7.**

A Excuse me?

**Q Exhibit 7. I'm sorry.**

A Got it. 02:59PM

**Q You were asked about a couple different sentences and I want to make sure I understand what your position is on a few issues.**

A Sure.

**Q The first one on Page 251, I'm sorry, the second full paragraph that begins with runoff, you were asked about the following statement: Runoff from agricultural land is one of the major sources of non-point source pollution. In reports to Congress, the USEPA has identified agricultural** 02:59PM 03:00PM

**non-point pollution as the major source of stream and lake contamination that prevents attainment of water quality goals identified in The Clean Water Act. Do you see those two sentences?**

A Yes.

**Q Do you recall being asked about those?**

A Yes.

**Q Are those two statements intended by you to be a comment on the source of any pollution that may be found in either Lake Tenkiller or the Illinois River watershed?** 03:00PM

A No. I think those are intended for just the general sources in the United States.

**Q You weren't intending to offer an opinion in that statement or in your testimony about it today regarding the extent to which, if at all, poultry litter contributes to contamination of either Lake Tenkiller or its tributaries?** 03:00PM

A No.

**Q You were asked, Dr. Daniels, a lot of general questions about the risk or potential of phosphorus runoff over the last few hours by Mr. Garren and in many of those questions they were just sort of abstract. Do you agree with that?** 03:01PM

MR. GARREN: Object to the form.



A They were general questions?

**Q Right.**

A Yes.

**Q General questions that did not reveal the specific litter applications or specific locations; correct?** 03:01PM

A Yes, in general terms, yes.

**Q Let's move away from generalities, if we can, for a moment to specifics. Professor Daniels, can you identify any specific location in the Illinois River watershed where litter has been applied which you have studied and investigated to an extent that you're willing to say that this location is a source of phosphorus or any other substance found in Lake Tenkiller?** 03:01PM 03:02PM

A No.

**Q You haven't prepared that sort of analysis, correct, or that form of that sort of analysis?**

A No, and I don't know of anyone that has. If they have, I'd like to see it. 03:02PM

**Q And you're someone who, I assume, keeps up on literature around the subject; correct?**

A Try to.

**Q And you haven't seen that sort of analysis presented in any literature?** 03:02PM



A I think there may be models that have done that but actual data collection, no.

**Q Back to Exhibit No. 7 on the next page, Page 252 --**

A Uh-huh. 03:02PM

**Q -- you were asked some questions about midway down the left column, advanced or accelerate eutrophication.**

A Uh-huh.

**Q Do you recall being asked some questions about drinking water and aquatic weeds?** 03:02PM

A Right.

**Q Sir, are you offering any opinions regarding the extent to which, if at all, poultry litter has contributed to the eutrophication of Lake Tenkiller?** 03:03PM

A I'm saying that this is what happens in a general context.

**Q So your statements both in Exhibit No. 7 and the questions you were asked about it by Mr. Garren were general statements as opposed to something specific?** 03:03PM

A Correct, not specific. Not to say Bosque River watershed or Illinois River or Eucha-Spavinaw. General terms.

**Q Would the same be true of this paper's** 03:03PM



**discussion of trihalomethanes; do you see that reference?**

A Yes, correct.

**Q You're not aware, are you, sir, of any work that's been done either by yourself or others that would establish the presence of trihalomethanes in drinking water and the Illinois River due to poultry litter?** 03:03PM

A No.

**Q I think I've said last question a time or two. This really is the last line, Dr. Daniels. You made a statement in response to one of Mr. Garren's questions about litter generally being applied within six to twelve miles; do you recall that?** 03:03PM

A Yes. 03:04PM

**Q Okay. Are you aware that today in 2007 that litter is being transported on a regular basis distances well in excess of six to twelve miles?**

A Yes.

**Q What's the farthest that you're aware of it being transported from northwest Arkansas?** 03:04PM

A I think south of Oklahoma City. I don't know how far that is but it's more than six miles.

**Q More than 100 miles, would it not?**

A Yes, yes. 03:04PM

MR. GEORGE: I'll pass the witness.

CROSS EXAMINATION

BY MR. McDANIEL:

**Q Good afternoon, Dr. Daniels. I'm Scott McDaniel. I represent Peterson Farms. Bear with me as I hop, skip and jump around just a little bit but I'll be brief.** 03:05PM

A You'll be the first one that's done that today.

**Q Well, we'll see if I can fulfill my promise.** 03:05PM

MR. GARREN: About being brief?

MR. McDANIEL: Yes.

**Q Let me ask you, sir, to look at Exhibit No. 8. 8.**

A 8?

**Q Yes.**

A Yes, sir.

**Q Will you take just a second and reread the very first paragraph in the introduction to yourself.** 03:05PM

A Out loud or to myself?

**Q To yourself.**

A Okay. Yes.

**Q In your earlier testimony in response to questions Mr. Garren was asking you, he covered this** 03:06PM

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**paragraph with you and then he asked you whether this was -- whether this paragraph, the statements in this paragraph applied to the Illinois River watershed and if I recall correctly, your answer was yes.** 03:06PM

A I'm sorry. I guess again what I should have said was that this is a general occurrence. Geographically this is what happens, not just -- not in the Illinois River watershed, not only in the Illinois River watershed. 03:07PM

**Q Were you saying that these scientific principles apply in the Illinois River watershed as well as other locations?**

A Yes, yes.

MR. GARREN: Object to the form. 03:07PM

**Q That was the intent?**

A Yes.

MR. GARREN: Object to the form.

**Q Were you suggesting by your answer that in fact phosphorus concentrations in runoff from pasture land was causing eutrophication of surface waters in the Eucha -- or excuse me, the Illinois River watershed?** 03:07PM

A No.

**Q I gather from your curriculum vitae and a number of the articles that you've written, that you've devoted a considerable part of your professional career to research and development of the concept of a phosphorus index; is that true?** 03:07PM

A It has been -- most of the work has been devoted towards things that relate to the phosphorus index, yes, and the phosphorus index itself.

**Q Are there -- about how many, generally speaking, scientists are there in the United States who also do research and writing in the area of phosphorus indices?** 03:08PM

MR. GARREN: Object to the form.

A Excuse me?

MR. GARREN: Object to the form, improper predicates. 03:08PM

A Judging from the SERA-17, size of 150 to 200.

**Q Sir, is the concept of a phosphorus index, is that the state of the art today as --**

MR. GARREN: Object to the form. Sorry.

MR. McDANIEL: Excuse me, Rick. I might fix it to your satisfaction by the time I get finished. 03:08PM

MR. GARREN: I doubt it, but go ahead.

**Q Sir, is the phosphorus index state of the art as far as a management tool for the agricultural utilization of animal waste?** 03:09PM

MR. GARREN: Same objection as to form.

A Yes.

**Q I understand the testimony that you gave in response to Mr. George's questions and that under the phosphorus index, poultry litter can be applied to pastures at levels in excess of a crop's need for phosphorus; is that correct?** 03:09PM

A Yes.

**Q And does that mean, sir, that phosphorus -- excuse me, that poultry litter can be applied to pastures at levels in excess of the phosphorus agronomic need without causing water pollution?** 03:09PM

A Yes.

MR. GARREN: Again, object to form. 03:09PM

**Q Does all soil have some background level of phosphorus?**

MR. GARREN: Objection, asked and answered.

A Yes, minor. It could be very minor, though.

**Q Referring to the soil, predominant soil types in northwest Arkansas and northeast Oklahoma, do those soil types have some degree of phosphorus in background?** 03:10PM

A Very little, yes.

**Q There's been several questions asked you about** 03:10PM

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**runoff of phosphorus today. Is it scientifically possible in this region of the country to have zero phosphorus runoff from a pasture?**
A Zero discharge is not possible.
**Q Why is that?** **03:10PM**
A It happens even under natural conditions.
**Q In your research that you've done, have you ever looked at phosphorus concentrations in runoff from forested areas?**
A Yes. 03:11PM
**Q And what did you find?**
A That under forestry conditions, there are a discharge of phosphorus.
**Q What can be the source or sources of the phosphorus in that runoff?** **03:11PM**
A It's a natural process of decomposition of the leaf litter and no fertilization but it's the decomposition of leaf litter.
**Q Assuming that these forested areas had a normal wildlife population, would wildlife be a source of phosphorus in the runoff?** **03:11PM**
A Yes.
**Q If you were to test runoff from a poultry litter amended pasture and you found phosphorus in the runoff, does that necessarily mean, sir, that** **03:12PM**



A Yes.
**Q Does -- what benefits, if any, does a healthy -- does healthy ground cover have in regard to surface runoff?**
MR. GARREN: Object to the form. 03:13PM
A Surface runoff is determined primarily by the amount of surface cover that exists, and that's one of the great advantages of why we have good water quality here is we've got pastures and we have pastures and we have like 100 percent surface cover, 03:14PM and the less surface cover you have, the more erosion and more runoff you're going to have.
**Q Can you explain how that works?**
A It's primarily due to the raindrop impact. The kinetic energy of the raindrops, as small as 03:14PM that may seem, will interact with the soil. Kinetic energy is dissipated when there's no surface cover, and the dispersion of the soil particle will occur immediately. Surface sealing will occur, and then infiltration will decrease and runoff will increase. 03:14PM
**Q Does the presence -- excuse me. Does the presence of ground cover reduce the rate of surface flow of runoff waters?**
A I'm sure it does. I don't have any numbers on it. 03:15PM



**that phosphorus will result in some impairment of surface water?**
A Well, depends on lots of things, the routing to the water body. Lot of things can happen.
**Q Sir, does the utilization of poultry litter to support forage and crops, does that necessarily result in water pollution?** **03:12PM**
MR. GARREN: Object to the form.
A No.
**Q The utilization of poultry litter to support crops and forage, does that likely result in water pollution?** **03:12PM**
MR. GARREN: Object to the form.
A No.
**Q You're fairly familiar, I gather, with agricultural practices in northwest Arkansas and northeastern Oklahoma. Would that be correct?** **03:12PM**
A Yes.
**Q Are there pastures out there where the forage is supported by the utilization of poultry litter?** **03:13PM**
A Yes.
**Q And does the utilization of poultry litter result in a healthy stand of forage?**
A Yes.
MR. GARREN: Object to the form. 03:13PM



**Q If the quality of the ground cover was reduced due to lack of adequate fertilization, what would be the result?**
A Erosion rate would go up and your runoff rate would go up. 03:15PM
**Q What would be the potential water quality impacts of that situation?**
A Well, it wouldn't be to advantage relative to a field that had good forage and had high surface cover. Your water quality could be -- potential for 03:15PM water quality impairment is high.
**Q You issued in your testimony what I took to be some cautionary statements about utilizing findings from these simulated rainfall plot tests to real-world conditions.** **03:16PM**
A Yes.
**Q Can you explain that?**
MR. GARREN: Object to the form.
A Yes. When we do rainfall simulations, you're talking about a small area that's probably a lot 03:16PM smaller than this table, and that by no means represents what is happening in the real world on a 500-acre watershed. All rainfall simulation work studies do is allow you to compare this treatment to the next treatment to the next treatment. You are 03:16PM

comparing relative terms, nothing near what is happening in the real world. Generally these will be much higher than if you did a study here the size of this table with a 5-acre watershed, 20-acre watershed, 2,000-acre watershed. The numbers would decrease in terms of concentration.

**Q Okay. In your experiences both as a resident in this area and professionally, have you had an opportunity to acquaint yourself with a number of poultry growers?** 03:17PM

A Yes.

**Q Do you have an opinion as -- a general opinion as to whether poultry growers are good stewards of the land?**

MR. GARREN: Object to the form. 03:17PM

A Judging from the people that I've encountered and also the -- yes, the answer to that is yes.

MR. McDANIEL: That's all I have. Thank you.

CROSS EXAMINATION

BY MR. TUCKER:

**Q Professor, my name is John Tucker and I am here for Cargill. I really did just have one question I think and, that is, is there a difference between soil test phosphorus numbers at a so-called** 03:18PM



**agronomic rate or agronomic STP rate, is there a difference between that and the capacity of soil to bind up chemically or chemically trap phosphorus in an amount substantially greater than the agronomic STP; is there a difference between the soil's** 03:18PM **capacity to bind and the so-called agronomic STP?**

MR. GARREN: Object to the form.

**Q And bind might not be the right word. If there's a better word, feel free to use it.**

A State your question again, please. 03:18PM

**Q Let me set it up a little bit better. We've heard testimony today about an agronomic rate. We've heard the fact that there may be an ability of the plant to utilize more than what is commonly thought of as the agronomic rate, whether it's an** 03:19PM **STP, a part per million, a 50 or 65 or whatever it is, and I'm asking insofar as the application of litter to the soil that contains phosphorus in litter, is the capacity of the soil to bind up or otherwise hold the phosphorus that's applied** 03:19PM **different than the so-called agronomic rate or STP rate?**

A Well, I think they're two different terms but let me -- maybe I can answer your question. When you apply phosphorus to soils and you're applying 03:19PM



let's say 100 pounds of phosphorus, that doesn't mean you increase the phosphorus in the soil by 100 pounds because the absorption capacity of the soil will basically deactivate and sequester a large percentage of that phosphorus to where you won't 03:19PM even see it in your soil test. That's one question.

Now, relative to agronomic rate, I'm not sure what you mean there. In other words, if the agronomic rate is 50 pounds per acre and you put out 50 pounds per acre -- 03:20PM

**Q I think what I'm saying is, would you agree that that's like an apples and oranges question?**

A Yeah, absolutely, you bet.

**Q And, for example, if as has been suggested by the lawyer asking the questions for the plaintiff,** 03:20PM **that you should identify an agronomic rate 50 pounds or 50 parts per million, 65 parts per million and that's where you should stop, my question is, if more phosphorus is applied to the soil than you would apply to get an agronomic rate of so-called 50** 03:20PM **or 65 parts per million, does the soil have the capacity to go ahead and absorb that extra phosphorus and hold on to it?**

MR. GARREN: Object to the compound nature of the question. 03:20PM



A Yes, and you would not apply -- if you were at that soil of 10 parts per million and you wanted to get it to the agronomic rate, you wouldn't apply that all at one time. You would do that over like a seven-year period. You would apply it and give it 03:21PM time to interact and to come to equilibrium, and over time you would build up to that point.

**Q And so if, for example, you already had a soil test of 65 parts per million and more phosphorus were applied, does that mean the soil would be** 03:21PM **unable to absorb the extra phosphorus and hold it as you described it?**

A No. It would be able to sequester a certain percentage of that, and every soil is different.

MR. TUCKER: I thank you. 03:21PM

MR. THOMPSON: None for me.

REDIRECT EXAMINATION

BY MR. GARREN:

**Q Dr. Daniel, Mr. George asked you about wildlife, and I think the discussions were involving** 03:22PM **Exhibit 13 and it had to do with inputs and outputs and nutrient balancing if you recall. Wildlife coming in and going out of the watershed really aren't going to impact it because there's a balance with what they eat and what they leave, is it not?** 03:22PM

MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
A Theoretically, no.
**Q Why not?**
A Well, you don't have buffalo migrating through the watershed that would bring in that quantity of manure.
**Q Well, here's my question: You have -- I think there was some statements about wildlife, like birds or other animals, too. They come in, they eat. They leave. There's no imported feed for them, is there?**
A No.
**Q And so there's generally a balancing, if you will, when you're not importing the feed or importing phosphorus for them to leave in the watershed; is that a fair statement?**
MR. GEORGE: Object to the form.
A I guess if you're asking are birds and wildlife a major source of phosphorus in the watershed --
**Q That's not my question, but you can answer that one.**
A I would say no.
**Q All right. Regardless of an index, if a plant**

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**is receiving only that nutrient which it needs, is there going to be runoff?**
A Yes.
**Q Okay, and that runoff is going to be what you referred to earlier as nominal; correct? I think that was your term.**
A May have been.
**Q Well, describe it for me. It's going to be nominal?**
MR. GEORGE: Object to the form.
**Q The runoff in the form of phosphorus loss?**
A Adding phosphorus probably will -- probably the soil properties will have more -- the inherent soil properties will have more effect on whether you get runoff or not.
**Q If we have millions and millions of chicken with imported poultry feed coming in and those chickens defecating and that waste being thrown on the land, that's going to create some runoff, is it not?**
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form.
**Q Runoff of phosphorus we're talking about.**
MR. McDANIEL: Same objection.
A If you're asking me if you applied chicken

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litter or any source of phosphorus, any source of phosphorus will result in phosphorus in runoff, yes.
**Q All right, and if you compare that to a normal background, let's say that nobody put any phosphorus in and you talked about, well, you have soils and the surface cover is also beneficial, but isn't it a fact that if there was never any phosphorus put in there and the soils were what they were intended to be normally, that runoff of phosphorus is going to be small compared to what we're seeing happen today, is it not?**
MR. McDANIEL: Object to the form.
A Again, it generally would be but if you have very infertile soil, you're going to have very infertile -- you're going to have very -- probably very low surface cover, so your total phosphorus level will be higher because of erosion.
**Q And that's even if you don't put any phosphorus in the watershed from poultry waste?**
A Yes, yes, yes.
**Q And is that level that you're talking about such that eutrophication can occur in short periods or over long periods of time as you normally might see?**
MR. McDANIEL: Object to the form.

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MR. GEORGE: Object to the form.
A If you are asking will -- is eutrophication a natural process, yes.
**Q All right, and normally that process takes some time, does it not?**
A Correct.
**Q Are we seeing in the Illinois River watershed an accelerated eutrophication?**
MR. GEORGE: Object to the form.
A Again, I'm not an expert on impact. You'd have to ask --
**Q The question with regard to the benefits that poultry litter has been described by you today as providing under questions by Mr. George, isn't it really a question of the benefits versus the harm that we also see from that poultry litter?**
MR. GEORGE: Object to the form.
MR. McDANIEL: Object to the form.
A Again, it gets to the question of where is too much too much in terms of the soil test P and those sort of things. On the short term, there is very definite benefits. Whether we can keep adding it and -- to infinitum, that question is no. I don't know where that number is.
**Q The water that we have on this earth is**

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**finite, is it not?**
A Correct.
**Q And ruining, spoiling that water creates a significant harm, does it not?**
MR. McDANIEL: Object to the form. 03:27PM
MR. TUCKER: It rains every day.
A I can't argue with you in general, no.
**Q If many towns, many people are reliant on the Illinois River for a source of water, it's important that water -- important for that water to remain clean, is it not? 03:27PM**
MR. GEORGE: Object to the form, improper predicate.
A Yes, it is, but human beings are part of the environment, and any action we have is going to have some impact on the water. 03:27PM
**Q And you live here in Fayetteville; correct?**
A Correct.
**Q Fayetteville doesn't rely on the Illinois River for its water supply, does it? 03:28PM**
A No.
**Q Have you undergone a study, sir, to determine the volume of cattle manure versus the volume of poultry manure that's in the Illinois River watershed? 03:28PM**



A No.
**Q When you were asked about microbial variables, your response was you were guessing; is that true?**
A I'm not an expert on microbes, sorry.
**Q So whatever you opined with regard to when you said I'm guessing, that's exactly what it was; correct? 03:28PM**
A Yes. Sorry, excuse me.
**Q And when they talk about I think in the questions and in that article they're talking about that the impairment designation might occur at a time where swimming wouldn't normally occur, nonetheless that water is still impaired if you were to swim in it; is that correct? 03:28PM**
A I can imagine it would be, yes. 03:29PM
**Q Do you know how long it stays impaired after it's had a high flow event, or that's out of your area?**
A I don't know. I'm going to have to have some more water. 03:29PM
**Q We can take a break if you want.**
A No. I'm fine.
**Q Do you know whether or not eutrophication is occurring in the IRW?**
A It's a natural process. 03:29PM



**Q Do you know whether it's accelerated in the IRW?**
A Do not know.
**Q And that's out of your area; correct?**
A Correct. 03:29PM
**Q You spoke that you knew of transportation of poultry litter as far south or as far away as a hundred miles maybe south of Oklahoma City. Do you know whether or not that particular transport was subsidized by any government funding? 03:30PM**
A I don't know for a fact, but it's my understanding it was by the 319 grant and the integrators put up some money.
**Q All right, and so when we talked about the 612 model area in your article, that was without subsidies, was it not? 03:30PM**
A Yes.
**Q So when you talk about the economic value, you in your articles were talking about what it was in an open marketplace without subsidy; correct? 03:30PM**
A Yes. I'd have to say from the sounds of it, we have one of the best hauling industries in the state, in the United States.
**Q Who is we?**
A The Arkansas -- I forget who is -- the term 03:30PM



but Sheri Herron runs a hauling operation. Apparently she is having trouble getting litter.
**Q When you were asked whether a phosphorus index was state of the art and I objected to that term, let me ask you this so I'm clear: Regardless, if we're relying on a phosphorus index, it's going to continue to allow runoff of phosphorus to continue to the water body; correct? 03:31PM**
A Correct.
MR. McDANIEL: Object to the form. 03:31PM
**Q You were asked whether or not you knew growers to be good stewards of the land. Have you ever inquired as to whether or not any growers have over applied poultry manure based upon soil test phosphorus? 03:32PM**
A Well, I'm sure I don't have to inquire of that. I'm sure that that occurs because they have nutrient management plans that allow them to do that.
**Q And do you consider that to be a good steward of the land? 03:32PM**
A Yes.
**Q Why?**
A Well, I think -- like we said, we think that the index is the best tool we have so far and it 03:32PM

reduces the risk of phosphorus loss.
**Q And prior to that index, they were relying on soil tests; correct?**
A No.
**Q In Arkansas they weren't relying on anything, were they?** 03:32PM
A Nor anywhere else.
**Q Well, Oklahoma since 1998 has had regulations. Arkansas only recently did in 2007; correct?**
A I don't know the dates, but it's been general that the -- even NRCS until the late '90's allowed land application of manure based on N. 03:32PM
**Q Would you agree that being a good steward would encompass being educated about the effects of your using poultry waste on your property?** 03:33PM
A Sure.
**Q And if you knew that several growers don't educate themselves as to this, are they still considered good stewards?**
MR. McDANIEL: Object to the form. 03:33PM
A I guess that's their choice if they choose not to.
**Q If one were to fudge a little on their soil test samples, is that considered someone who would be a good steward?** 03:33PM

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MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form, improper predicate.
A The question of soil test is not an issue with the index. 03:33PM
**Q If it's required to have a soil test before you land apply poultry waste and you fudge on that taking of that soil test or you don't take it as recommended, are you considering that person still a good steward?** 03:34PM
MR. GEORGE: Same objection.
A So you're saying they're cheating on the soil test?
**Q Yeah. Let's say somebody takes one sample from every field, several fields, mixes those together and turns that in as a sample for each field. Is that considered a good soil sample?** 03:34PM
A That's bad for human -- it's not only bad for humans as a producer but potentially bad for the environment. 03:34PM
**Q When Mr. Tucker was asking you some questions about binding and agronomic rates, and you made a statement that you would normally would want to apply over a period of seven years?**
A Uh-huh. 03:34PM

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**Q Do poultry growers apply over a period of seven years?**
A They wouldn't have to do that now because of their levels are already there.
**Q What about -- what do you mean by levels are already there?** 03:35PM
A Well, I mean in most cases they're at a medium to optimum range of soil test P or at least certainly in the fields close to the house are.
**Q And that's as a result of various studies you've done?** 03:35PM
A No. It's just I've done some in Wisconsin that indicate that.
**Q That would indicate that they don't go very far when they apply the poultry waste out of the barn; is that a fair representation?** 03:35PM
A I think that's been a practice in the past and the phosphorus index is designed to move that manure over a more even distribution.
**Q You made a statement earlier that we have good water quality here. Where is here?** 03:36PM
A Northwest Arkansas.
**Q Okay, and what is the basis for that?**
A Well, just it's a subjective basis to some degree from DEQ's reports that extraordinary 03:36PM

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resources at Kings River, you know, beautiful fishing, canoeing the river, those sorts of thing.
**Q In that study do you know what kind of --**
A It's not a study. It's subjective.
**Q Subjection. Did that subjective report mention the volume of poultry waste application in that same watershed?** 03:37PM
A No.
**Q Did it take it into consideration in making that determination?** 03:37PM
A No.
**Q And do you know whether or not the poultry population in that area of that watershed is comparable to the Illinois River watershed?**
A Don't know. 03:37PM
**Q Would you characterize the level of phosphorus in the Illinois River watershed as low, medium or high?**
MR. McDANIEL: Object to the form.
MR. GEORGE: Object to the form. 03:37PM
A I don't know. I wish we knew that. I wish we had a way of deciding, of determining what the levels are.
**Q And the soil test data bank that we talked about earlier today, in looking at that, that** 03:37PM

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**doesn't give you an indication?**
MR. GEORGE: Object to the form.
A I don't really know. Nate is the gentleman that would be able to answer that question.
**Q All right.** **03:38PM**
MR. GARREN: I don't have any other questions.
RECROSS EXAMINATION
BY MR. McDANIEL:
**Q Dr. Daniels, that little bit of testimony in response to those questions by Mr. Garren has prompted me to ask you a couple more questions. Pasture grasses, Bermuda or fescue, are those the predominant forage grasses in northwest Arkansas --** **03:38PM**
A Yes. 03:38PM
**Q -- and eastern Oklahoma? I assume within the body of the leaves of grass there will be a form of phosphorus or phosphate; is that true?**
A Correct.
**Q Is that phosphate that's in that grass, is that generally something that presents any risk of harm to the environment?** **03:38PM**
A Well, it wouldn't -- the environment wouldn't distinguish between phosphorus from the forage decomposition and chicken litter or commercial 03:39PM



fertilizer, and it would be the same.
**Q Is that form of phosphorus generally viewed as being soluble or insoluble?**
A While it's in the plant itself, it is insoluble. As decomposition occurs, it would become soluble. 03:39PM
**Q With regard to what creates the greater environmental concern, is soluble phosphorus the greater concern rather than the insoluble fractions?**
MR. GARREN: Object to the form. 03:39PM
A I think the soluble is of concern because it has potential immediate effects. Long-term total P is what the limnologists use.
**Q The insoluble fractions of phosphorus, do they actually have to be physically relocated off of a field in order to potentially reach a water resource?** **03:39PM**
A Yes.
**Q By erosion or some other physical force?**
A Yes. 03:40PM
**Q Is that different from how soluble P may move from a field surface?**
A Both would be transported in the water.
**Q Is soluble P more easily transported from the surface of the field than insoluble P?** **03:40PM**



A Yes.
**Q All right. Well, let's talk about cattle. Cattle eat these grasses we've been talking about and cattle will retain some amount of phosphorus within their tissue; is that a true statement?** **03:40PM**
A True.
MR. GARREN: Object to the form.
**Q Do cattle also excrete phosphorus?**
A Yes.
**Q And is -- what is the form of that phosphorus generally speaking?** **03:40PM**
A It would be very similar, would be either in the soluble form or in organic insoluble form.
**Q And where is -- this may be the easiest question all day. Where do cattle usually deposit their manure?** **03:41PM**
A In a field.
MR. GARREN: Object to the form.
**Q In a field or in a water body of some type if they're loafing in the water?** **03:41PM**
A Yes.
**Q Do cattle convert the form of phosphorus by virtue of their biological activity; in other words, do they take phosphorus that is in one form in the grasses and by digesting it and then depositing it** **03:41PM**



**on the surface, do they change the phosphorus in any regard in respect to how that phosphorus may be relocated off of that field?**
MR. GARREN: Object to form.
A No, but they are a ruminant, and they can digest more of the organic phosphorus in the grain than monogastric cows. 03:42PM
**Q All right. I need to let him change his tape.**
A And I need to go to the bathroom.
VIDEOGRAPHER: We are off the Record. The time is 3:42 p.m. 03:42PM
(Following a short recess at 3:42 p.m., proceedings continued on the Record at 3:47 p.m.)
VIDEOGRAPHER: We are back on the Record. The time is 3:48 p.m. 03:48PM
**Q Dr. Daniels, what I'm attempting to do is to ask you to help me put this in terms understandable to a lay person. If surface water flows across blades of fescue grass, will that pick up phosphorus from the grass and transport it off the field?** **03:48PM**
A A negligible amount.
**Q If surface water flows across cow manure on the surface of the ground, is there a potential that it's going to pick up phosphorus and transport it off the field?** **03:48PM**

A Yes.
**Q Then by cattle consuming grass, are they converting the phosphorus in the grass into a form that has a greater potential for causing harm to water resources?** **03:49PM**
A Yes.
**Q Thank you. There was a question asked by Mr. Garren and the -- he asked you that in the case of a phosphorus index, that even if a phosphorus index is being utilized on a land application site, there remains a potential for runoff. Is that your opinion?** **03:49PM**
A Yes.
**Q And in my prior questioning, I tried to draw a distinction in your testimony between edge of field detectable runoff and runoff that actually reaches some water body. Do you recall that testimony?** **03:49PM**
A Yes.
**Q Now, Mr. Garren asked you with regard to the phosphorus index that it will -- even using a phosphorus index, will result in runoff to a water body was his question, and what is your answer to that question?** **03:49PM**
A My answer to that question is that it will result in runoff from that field that the index has 03:50PM



been conducted on. There's no such thing as zero runoff.
**Q All right. So it will be runoff that could be detected on an edge of a field basis?**
A Correct. 03:50PM
**Q You're not offering an opinion that a phosphorus index results in runoff to a water body, are you?**
A No.
**Q Prior to the State of Arkansas enacting its nutrient management laws, were the conservation offices in Arkansas writing nutrient management plans for poultry growers using a phosphorus-based criteria?** **03:50PM**
MR. GARREN: Object to the form and predicate. 03:51PM
A I am not sure about that. I don't know how far you want to go back, but in Washington County I think they were using it as a rule of thumb, and in Washington and Benton they were using a cut-off level. I'm not sure about that. 03:51PM
**Q What is referred to as the Arkansas phosphorus index, when was that first used, sir?**
A Probably 2003, 2002, something like that, 2004. I think Paul DeLong's articles are 2004. 03:51PM



MR. McDANIEL: That's all my questions. Thank you.
MR. GARREN: Dr. Daniel, you have the right to read this deposition and make corrections to it if you feel they are necessary and you have to return it within 30 days to the court reporter with the errata sheet. You also have the right to waive that reading and signing of the deposition if you choose, but you are required by law to state which of those you wish to do on the Record. 03:51PM
THE WITNESS: What would you recommend?
MR. GARREN: I can't make that recommendation.
MR. McDANIEL: I can tell you that I would recommend and go ahead and accept a copy of it and read it. You can -- 03:52PM
THE WITNESS: Eight hours of it, okay. All right. I'll do it.
VIDEOGRAPHER: This concludes the deposition of Dr. Tommy Daniel. We're now off the Record. The time is 3:52 p.m. 03:52PM
(Whereupon, the deposition was concluded at 3:52 p.m.)



SIGNATURE PAGE

I, Tommy Daniel, PhD, do hereby certify that the foregoing deposition was presented to me by Lisa A. Steinmeyer as a true and correct transcript of the proceedings in the above styled and numbered cause, and I now sign the same as true and correct.

WITNESS my hand this _____ day of _____, 2007.

_____
TOMMY DANIEL, PhD

SUBSCRIBED AND SWORN TO before me this _____ day of _____, 2007.

_____
Notary Public

My Commission Expires:
_____

C E R T I F I C A T E

STATE OF OKLAHOMA )
) ss.
COUNTY OF TULSA )

I, Lisa A. Steinmeyer, Certified Shorthand Reporter within and for Tulsa County, State of Oklahoma, do hereby certify that the above named witness was by me first duly sworn to testify the truth, the whole truth and nothing but the truth in the case aforesaid, and that I reported in stenograph his deposition; that my stenograph notes were thereafter transcribed and reduced to typewritten form under my supervision, as the same appears herein.

I further certify that the foregoing 197 pages contain a full, true and correct transcript of the deposition taken at such time and place.

I further certify that I am not attorney for or relative to either of said parties, or otherwise interested in the event of said action.

WITNESS MY HAND AND SEAL this 7th day of December, 2007.

_____
LISA A. STEINMEYER, CRR
CSR No. 386 03:52PM

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CORRECTIONS TO THE DEPOSITION OF TOMMY DANIEL, PhD

| PAGE AND LINE NUMBER | CORRECTION |
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